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Specification of the Patent granted to PETER STORCK, *of John-street, Tottenham Court Road, in the County of Middlesex, Baker; for a Substitute for Brewers' Yeast, which may be made and used in all Weathers and in all Climates.* Dated June 21, 1803.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Peter Storck do hereby declare that the nature of my said invention of a substitute for brewers' yeast, which may be made and used in all weathers and in all climates, and the manner in which the same is made and performed, is described and specified in manner following; that is to say:

To make the Fermentation *.—Take six pounds of malt and three gallons of boiling water, mash them together,

* It is hardly necessary to remind our readers, that we never venture to alter the language of patentees.—Specifications being legal instruments, we think it our dnty to give the exact words of the enrollment.

cover it close, let it stand three hours; then draw the liquor off, and put two pounds of brown moist sugar to each gallon of the liquor; stir it well about in the vessel until the sugar is dissolved; then put it in a small cask, only large enough to contain it; cover the bung-hole of the cask with brown paper only; let it be blood-warm; take care not to keep it in a cool place, lest you check the fermentation; let it stand four days: then prepare the same quantity of malt and boiling water in the same manner as last mentioned, without sugar. Take the fermentation out of the vessel; mix it well together with the last-mentioned liquor, when blood-warm; let it stand forty-eight hours, when it will be fit for use. This fermentation, thus prepared, renders it unnecessary to make any new store whilst any of the same remains. To make twenty-six gallons (ale-house measure) of the substitute, allowing to each gallon two pounds of malt and one ounce of hops, and so in proportion for a less or greater quantity.

The Process. — Put twenty-six ounces of hops to twenty-six gallons of water; boil it for full two hours, so as to reduce the liquor to sixteen gallons. Then take the sixteen gallons of liquor so boiled, and mash it with the malt, when the liquor is one hundred and ninety degrees in warmth, or near boiling heat; let it stand two hours and a half, and then drain it off; put it in a clean vessel or cooler; take ten gallons of boiled water, of the same heat; mash it up with the before-mentioned malt; let it stand two hours and a half; then drain it off in another vessel or cooler. Take the first liquor, so prepared, when blood-warm, (or according to the state of the atmosphere at the time of making it,) and put to it four quarts of fermentation hereinbefore specified; mix it well; let it stand ten hours. Take the remaining ten gallons

gallons of the liquor, and put it with the said sixteen gallons of liquor, so prepared as hereinbefore is mentioned; let it stand six hours, and then it is fit for use, in the same manner, and for the like purposes, which brewers' yeast is made use of. A proportionable quantity of this substitute should be reserved as a store, for the purpose of fermenting other liquor, so as aforesaid prepared, to make more substitute for yeast. The advantages attending this invention are, that the substitute for yeast will keep sweet and good longer than brewers' yeast, may be made and used in all weathers and climates, and is the means of making bread more white and lighter than brewers' yeast.

Directions how it is to be used.—Two gallons is sufficient for twelve bushels of bread, set quarter sponge, blood-warm; let it come to its full height, which it will do in four hours, or rather more; and keep it cooler than brewers' yeast throughout the whole process.

In witness whereof, &c.

Specification of the Patent granted to CHESTER GOULD, *of Red Lion-street, Clerkenwell, in the County of Middlesex, Gentleman; for a Glass, on a new Principle, to be used by Mariners at Sea instead of the common Sand Glasses when heaving the Log, for the Purpose of ascertaining the Ship's Rate of sailing, and also for other Uses on Land or at Sea.* Dated May 28, 1803.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Chester Gould do hereby declare, that the nature of my said invention, and in what manner the

same is to be performed, are as follows; that is to say: Instead of the half minute and quarter minute sand glasses now commonly used at sea when the log is thrown for the purpose of ascertaining the ship's rate of sailing, I procure to be blown glasses about the shape and size of an orange, or of a hen's egg, with a small hole in each end. These holes I enlarge with a small round file, such as is used by watch-makers, till the glass, being filled with water, will empty itself at one end in half a minute, and at the other end in fifteen seconds, or such other period of time as convenience may require, thereby making one of these glasses answer the purpose of two sand glasses. The shape and size of these glasses, as described above, I consider to be as convenient and proper as any other shape or size; yet in these respects they need not to be limited, but may be varied according to the fancy of those who are concerned in manufacturing and using them, provided they are made to run out exactly in the time required. Some I make to measure time at one end only, leaving the other end open, so that they may be more readily filled. When they are prepared for use, they are filled with water by immersing them in a bucket, or other vessel of water, and the water prevented from escaping till the proper time, by placing the thumb over the hole at one end of the glass. They are used in the same manner and for the same purpose at sea as the common sand glasses are. They are much more correct and uniform in their action, and less liable to accident. They may also be made to run a longer time, to answer several purposes on land as well as at sea.

In witness whereof, &c.

Specification

Specification of the Patent granted to Robert Kirkwood, *of Edinburgh, Engraver, and Copper-Plate Printer; for certain Improvements on the Copper-Plate Printing-Press.* Dated February 28, 1803.

With a Plate.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Robert Kirkwood do hereby declare, that the nature of my said invention is particularly described as follows; that is to say: In the usual method of copper-plate printing, the paper on which the impression is to made being laid on the plate, and both laid upon a plank, the whole are passed through between two cylinders, which press on one another, revolving on axes.

In printing common work the pressman passes the plate and paper through, and returns them to himself, remaining in the same place for convenience. This mode of passing the plate and impression twice through the cylinders often doubles the impression, and always renders it coarse and obscure.

For a more perfect impression, the pressman passes the plate and paper only once through, that is, from himself to the other side of the press, and then, going round, carries back the plate and impression to his former situation. This is called printing *through press*, and, requiring more time and trouble, is generally charged double both by the journeyman and master. My improvements are as follows, *viz.*

The circular form of the upper cylinder is interrupted, broken, or altered, by a part of it being in some degree flattened; so that when all the remaining circular part of it, in turning round, has borne on the plate, the flat part

part is then presented to the plate, which causing a vacuity, (at the same time, the upper cylinder being supported,) the pressure on the plank and plate is at an end, and they are returned by machinery or the pressman to their former position, where he remains to receive them, and repeat the operation.

I add, when required, a movement, by clock-work, forming part of the press, for the purpose of numbering the impressions. This movement is described by the annexed drawing and explanation; but any other apparatus producing the same effect may be applied.

The interruption or alteration of the circular form of the cylinder is made on one or more parts of it, according to the size of the plate, or different cylinders may be used for different-sized plates.

Another means of improving copper-plate printing-presses is, to retain the circular form of the upper cylinder, and make interruptions or alterations on the lower cylinder, at the same time fixing two rollers or other support for the plank to be drawn back upon, while unsupported by the lower cylinder.

Another means of producing the desired effect is, to preserve the circular form of the upper and under cylinders, and raise or suspend the upper cylinder, or lower the under cylinder, by a lever on each side of the press, or other mechanical contrivance, in order to allow the plank and plate to return to the workman without passing twice through the cylinders, or obliging the workman to go round the press, or reach over the upper roller for his plate and impression, as is usual in printing through press.

The annexed drawing and references will more fully exemplify the application of my said invention.

In witness whereof, &c.

REFER-

REFERENCES TO PLATE X.

Fig. 1, a perspective view of the press.

A, the circle of the roller interrupted; which, by being supported, permits the plank to be drawn back after the circular point has borne on the paper and plate.

B, the lacing or fastening of the blankets, (see Fig. 4.)

C, C, a pulley and weight, which draws back the plank when the interception is presented to the paper and plate after the circular part has compleated the impression.

D, a rope (another of which is on the other side of the plank) which checks the plank in bringing it to its former position, (see Fig. 3.)

E, a small roller, the width of the frame on which the plank runs when it is pulled back, (see Fig. 3.)

F, a handle fixed to the plank, by which the pressman directs and steadies the plank in returning it.*

G, an index, for numbering the impressions; effected by the motion of the upper roller, which cannot be moved when the motion of the press is reversed.

Fig. 2, side-view of the press.

A, A, A, A, dotted lines, represent the two interceptions (same as A A, Fig. 5.)

H H, support to the rollers when a flat side is presented to the plank.

I, I, the circular parts of the roller, which press alternately on the paper and plate, and thereby make impressions, (same as Fig. 6.)

D, one of the check ropes, (described in Fig. 1.)

E, a small roller, at the back of the press, (as Fig. 1.)

Fig.

Fig. 3, a back-view of the press.

K K, space between upper roller and plank, when one of the flat sides is presented to the plank.

E, the small roller affixed to the frame of the press, on which the plank runs when it is pulled back.

L L, brass sliding frame, for ditto to adjust it to the proper height, (see Fig. 6.)

D D, two ropes, which check the plank.

Fig. 4, the upper roller by itself.

I, I, the two circular parts, as described in Fig. 2.

A A A A, one of the flat sides.

B, the lacing or fastening of the blankets to the pins M.

N, N, two points, by which the index is effected, (see Fig. 7); these points to be more or fewer according to the number of interruptions in the circle of the roller.

Fig. 5, an end-view of the upper roller, as described in Fig. 2.)

Fig. 6, the two brass frames for small rollers, (as Fig. 3.)

Fig. 7, the index.

O O, the end of axle of upper roller.

N, N, two points fixed to ditto, to effect the index.

Fig 1.

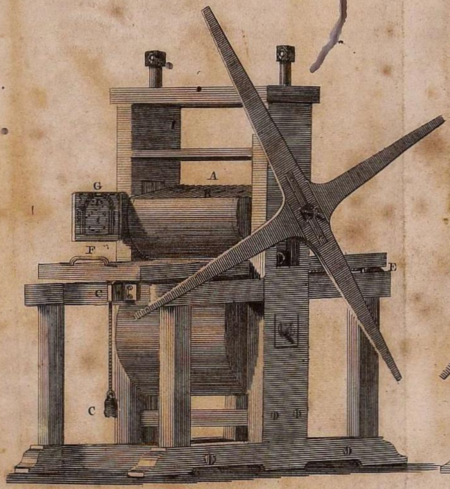


Fig 2.

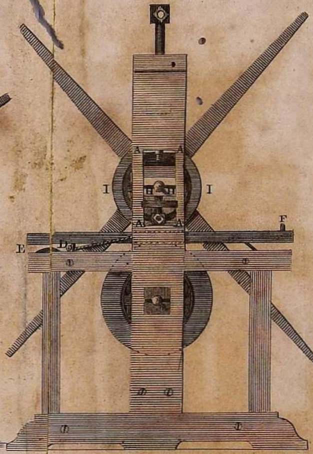


Fig 3.

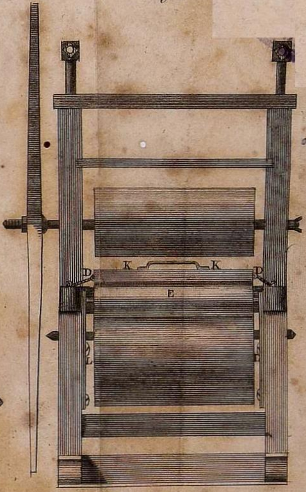


Fig 4.

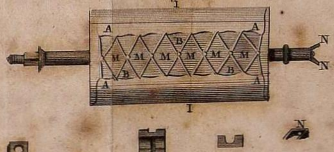


Fig 7.

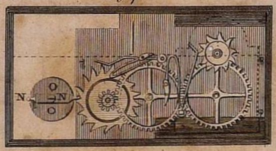


Fig 6.

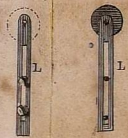


Fig 5.

R Roffe

Specification of the Patent granted to ROBERT MASON, *of St. Thomas's-street, Portsmouth, in the County of Southampton, and late of Cumberland-street, Portsea, in the said County, Gentleman; for certain Improvements on a common Waggon, whereby the same may occasionally be separated and used as two Carts, denominated "The Patent Hampshire Waggon."*

Dated February 28, 1803.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Robert Mason do hereby declare that my said invention is described in manner following; that is to say: The waggon is formed by two distinct frames or parts, which I term the fore and hind carts, as they correspond with the fore and hind parts of a common waggon, with the exception only as to the pole, those carts having one each; that of the fore cart turns upwards from the main pin on the under side thereof. A roller may be fixed for the sweep of the hounds to lock on until it reaches the back shudlock, to which it is secured, and extends about four inches behind the extreme thereof, which projection passes under the fore shudlock of the hind cart, through which and the said projection of the pole an iron pin is to pass, and secured on the under side by key, or nut and screw. The pole of the hind cart to proceed from the hind shudlock through the pillow or axletree, turning upward to the front shudlock, being secured thereto, and extending about four inches from the extreme thereof; which projection passes under the hinder shudlock of the fore cart, through which and the said projection of the hind pole an iron pin is to pass, and secured, as described, with the pole of the fore cart.

As the projections of the two poles are to pass close to each other, it is necessary one should incline to the right, and the other to the left.

The pins here described as passing through the shudlocks and projections of the poles, by which the carts are in part united, are to be removed, and passed through the bed into the fore axletree, one on each side the main pin, to prevent its locking when used as a cart. The sides and shudlocks of the carts are united with hooks and eyes, or other substantial fastening; but the most simple and secure that I recommend, is two strong iron straps, fastened to the top and bottom sides, nearly at each end of the hind shudlock of the fore cart, so as to run and pass on the sides thereof, and projecting behind the shudlock about two inches and a half, with an eye or hole in such projection. These straps I term union eyes: one union eye, of a similar description, is fixed to the centre of the front, nearly at each end of the fore shudlock of the hind cart, by two straps clasping the shudlock, one passing over and the other under the sides of the said cart, so as to come in contact, and fill up the whole space between the two union eyes, described as being nearly at each end of the hind shudlock of the fore cart. The centre of these union eyes should be exactly in a line with the meeting of the two shudlocks to which they are secured; and these union eyes may be made square to their extreme end, or snipe-billed, or wedge-like, which I should rather recommend, as it would tend to unite them the more easily. Also two other union eyes are fixed one on the under side of each of the upper raves of the fore cart, at the hind part thereof, and two others fixed one on each of the upper raves of the hind cart at the front thereof. The eyes and holes in those fixed to the upper raves I would recommend to be square, and those

on the shudlocks round; these union eyes may be placed *vice versa*, that is to say, four on the fore shudlock of the hind cart, and two on the hind shudlock of the fore cart; and on the top of the upper raves of the fore cart, and on the under side of such raves of the hind cart, instead as above set forth; so that the whole five union eyes on each side of the waggon are in contact, through which a long iron pin is to pass, which may be square, from the top or head thereof, until it meets the shudlock, and thence round, to correspond with the union eyes on the shudlocks, and may be sufficiently long to pass through an iron strap, fixed for that purpose to the shafts of the hind cart, and secured at the under side thereof by a key, or nut and screw. It will be necessary to put a strouter iron on each side, and within about two inches of the extreme end of the fore cart; and also a strouter iron on each side, within about the like distance from the front of the hind cart. The shafts of the hind cart are to be united thereto in the usual way, and to pass under the bed, and on the pillow of the fore cart. The front bolt of the hounds to be brought forward near to the extreme end or nose thereof, which will tend to resist the strain in locking, as the hounds pin passes behind the said bolt in securing the shafts to the hounds. The nose of the hounds I would recommend to curve a little upwards; it will tend to throw the shafts somewhat higher when used as a cart.

When the waggon is divided and used as carts, the shafts of the fore carts are to be removed back on the hounds about ten inches to other holes, which now come in contact for the hounds pin to pass through, to secure the shafts to the hounds. By the shafts being thus moved back on the hounds, the nose thereof is brought nearly to the hind bolt of the shafts, a piece of iron or

wood being fastened on the under side thereof, to prevent the hounds dropping down or passing through the shafts. There may be two straps of iron, which I term struts, fastened one withinside of each of the sides of the fore cart by an iron pin, and, having an eye at the lower end thereof, through which the hounds pin should pass when securing the shafts to the hounds, as these will tend to support the front part of the cart, as also the hounds, in tipting to discharge a load. These struts may be laid up under the bed when a waggon, by hooks placed for that purpose. There must then be another hole on each side of the shaft nearer to the bolts, to come in contact with these holes in the fore part of the hounds that are occupied by the hounds pin when a waggon. Through these another long pin, or two short ones, are to pass, to secure and depress the nose of the hounds to the shafts; which pin or pins are to be fastened by keys, or nuts and screws; but in case the carts are to be used as tip-carts, then the shafts of the fore cart being fastened to the hounds and struts by the hounds pin only as above described, a strap of iron is to clasp the front bolt of the hounds, being secured at the top and bottom sides, and projecting from the front thereof about three inches, having in such projection a mortise or square hole in the top, and another corresponding therewith, only being a little longer in the under side: these holes must be in contact with each other. These straps I term the tip-strap, through which an iron bar, corresponding with the mortise holes, is to pass, having several holes therein, and a stop at the top, to prevent its passing quite through, this I term the tip-iron, and which is to be received at the under side of tip-strap on a strong hook, fixed at the under side, and at the back of the hind bolt of the shafts, or on a strong iron pin, similar to the hounds pin, which

is

is to pass through a strap of iron fixed to the under side of each side of the shaft, so that, by putting a small iron key though either of the holes in the tip-iron above the tip-strap, the nose of the hounds may be depressed or elevated, as occasion may require. I should recommend this tip-iron to be a little curved, so as to come just under the fore part of the bed of the cart. The shafts of the hind cart are to be fixed with hooks and eyes, or other usual fastening, having a staple fixed to, or mortise in, the front bolt, or in a cross bolt fixed thereto for that purpose; and another strong strap of iron, with a mortise therein, fixed to the under side of the front shudlock to the projecting part of the pole. These two mortises are to be in contact, so that a tip-iron, similar to that for the fore cart, may pass through both, having a stop at one or both ends, to prevent its passing through, so that a small iron key being introduced to either of the holes in the tip-iron, the body of the cart is depressed to the shafts, or elevated, as occasion may require. And in order that this tip-iron, if left in this situation when the carts are united, may not hang down, or be in the way, a joint hinge may be made in it, to fold up under the shaft, or a hook may be fixed to the front bolt of the shaft, so as to receive the end of the tip-iron the same as that for the fore cart, so that it can be very easily removed. The tail-board of the fore cart may be secured with either one or two starts, fixed at the bottom thereof, to go into the shudlock, and two other starts from the top rail thereof, one at each end, to drop into the union eyes fixed to the upper raves; but if a narrow tail-board only be required, then two starts are to be fixed at the bottom edge, one at each end, so as to drop into the union eyes of the shudlock, and secured at the under side thereof by a key. The head-board

board of the hind cart to be secured by two starts from the bottom thereof, to go into the shudlock, and having a hole in each end of the top rail to come in contact with the union eyes to the upper raves. Through these the long iron pins, which are used to unite the carts, are to pass, taking the same situation as when the waggon is compleat. Two iron sockets, about five inches long, are to be fixed at the binder part of the over or outer raves of the fore cart, so as to receive the front ends of the said raves of the hind cart. The head and tail ladders, and all other usual or necessary things used with common waggons may be applied to this. The head ladder may be removed to the front of the hind cart. If occasion require I have also other ladders, which I denominate side ladders, made of wood or rope, two for each side, with eyes at the lower ends thereof, to be fastened to two hooks, fixed for that purpose to each of the over or outer raves, one at each end. These hooks may be made to secure such raves to the strouters. As these side ladders are only for the purpose of securing all loose loads, such as barley, oats, hay, &c. and as every waggon may not require them, I wish to conceive myself at liberty to dispose of waggons with or without them. Should it be wished the hind cart to be drawn by horses abreast, or curricle fashion, then the pole of the hind cart to be continued sufficiently long, and pass under the bed of the fore cart, through which the main pin may be made to pass, as also a pin at the hind shudlock of the fore cart.

Waggons of usual pattern or fancy may be made on this principle, but those which are made so that the fore wheels lock entirely under the bed; the fore pole may be dispensed with.

Brewers' drays may also be made to unite on this plan.

In witness whereof, &c.

Experiments on the Quantity of Gases absorbed by Water at different Temperatures, and under different Pressures.

By Mr. WILLIAM HENRY.

With a Plate.

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY.

THOUGH the solubility of an individual gas in water forms, generally, a part of its chemical history, yet this property has been overlooked in the examination of several species of the class of aëriform substances. The carbonic acid indeed is the only gas whose relation to water has been an object of much attention; and, at a very early period of its history, Mr. Cavendish, in the course of inquiries, the results of which were the groundwork of the most important subsequent discoveries, ascertained, with peculiar care, the proportion of carbonic acid gas condensible in water at the temperature of 55° of Fahrenheit. Dr. Priestley also, about the same period, directed his attention to the saturation of water with fixed air, and contrived a simple and effectual mode of obtaining this impregnation. His apparatus afterwards gave way to the more manageable one of Dr. Nooth; and this, in its turn, has been superseded by the improved mode of condensing into water many times its bulk of various gases, invented and practised by several chemical artists (as well as by myself), both in this country and abroad.

The influence of pressure, in accomplishing this strong impregnation, was first, I believe, suggested by Dr. Priestley. "In an exhausted receiver," that most ingenious philosopher observes, "Pyrmont water will ac-

"tually

"tually boil by the copious discharge of its air; and I "do not doubt, therefore, that by means of a con-"densing engine water might be much more highly im-"pregnated with the virtues of the Pyrmont spring *."

Before describing my experiments on the effects of additional pressure, in saturating water with gases, it will be necessary to state the results of others, that were previously expedient, to determine the quantity of each gas combinable with water, at a given temperature, and under the ordinary weight of the atmosphere. In a few instances also it was deemed proper to ascertain the influence of different temperatures over the condensation of gases in water.

SECTION I.

On the Quantity of Gases absorbed by Water, under the usual Pressure of the Atmosphere.

In order to attain considerable minuteness in observing the proportion of gases absorbed by water, an apparatus was employed, of which the following is a description.

The vessel A, (Plate XII. Fig. 1,) is of glass, about 2 inches diameter and 4½ inches long. It is graduated into cubical inches, and quarter inches; and furnished at the top with a brass cap, into which a cock *a* is screwed. To the lower aperture a copper tube C is cemented, which is bent at a right angle, the leg nearest the vessel being carried downwards, and furnished with a cock *b*. B, is a glass tube, of about ¼ inch bore, bent at a right angle, and graduated, from a given point, into hundredth parts of a cubical inch. It is attached to the copper pipe, by a tube of Indian rubber D, over which is a

* Experiments on air, arranged and methodized, vol. I. p. 51.

covering

covering of leather, forming a joint, which admits of the vessel A being briskly agitated. When the apparatus is used, it is first filled with quicksilver; a transfer bottle of elastic gum, furnished with a cock, and containing water of a known temperature, is screwed on; and a communication is opened, through the cocks, between the bottle and the glass vessel. The lower cock *b* is then opened, through which the mercury runs out, while its place is supplied by a quantity of water from above, measurable by the scale on A. This transfer is removed, and another containing gas being substituted, a measured quantity of gas is admitted in a similar manner. Strong agitation is now applied, by means of the joint D; and mercury is poured into the tube B, to supply the descent occasioned by the absorption in A; its level being exactly preserved in both legs of the syphon, both at the commencement and close of the experiment. The quantity of mercury required for this purpose, indicates precisely the amount of the gas absorbed.

The only advantage of this apparatus over a cylindrical jar, inverted in the usual way over mercury, is, that, by means of the tube B, very minute degrees of absorption may be measured, which would scarcely be perceived in a wide vessel.

For the more absorbable gases, I found this instrument to answer perfectly well; but, for ascertaining the solubility of those which are taken up by water in only small proportion, I preferred one of different construction. It consisted simply of a glass vessel, of the capacity of $57\frac{1}{2}$ cubical inches, and shaped as in Fig. 2. At *a* was cemented a cock, provided with a screw; and the lower cock *b* was of glass, accurately ground in. The vessel was then filled with water which had been long boiled; a lifting valve was screwed on *a*, the cock being open;

open; and the vessel was placed under the receiver of an air pump, where it was kept for some time, the pump being occasionally worked, as long as any air bubbles could be seen to arise. The gas under examination was next admitted from an elastic bottle, the cock *b* being opened, and a measured quantity of water let out. The gas and water were then violently agitated together; and the cock *b* opened under mercury, which ascended into the vessel. The agitation was still continued, observing to preserve the same level of mercury without as within the vessel; and, when it rose no higher, the ascent was noted by means of the graduated scale. The quantity of mercury that had entered the vessel, indicated the amount of absorption that had ensued.

It might, however, be objected, that the water would acquire air again while poured into the vessel; and I therefore sometimes used large glass globes, having long necks, accurately graduated. These globes, being of very thin glass, were filled with boiling water, and inverted instantly in a trough of quicksilver. When the water became cold, the mercury was of course found to have risen partly into the vessel. This portion was displaced by a measured quantity of gas; and the absorption was denoted by the ascent of the mercury in the graduated neck.

The water employed in these experiments was boiled, during several hours, in a tin vessel, having an aperture barely sufficient to allow the egress of the steam, and poured, while boiling hot, into glass vessels, which were corked, and tightly tied over with bladder. An equable temperature was produced in the water, mercury, and gas, except when above 85°, by regulating that of the room in which the experiments were made; and the glass vessel, during agitation, was carefully guarded

from

from the warmth of the hand. The agitation was continued till it appeared, by the scale, to produce no farther effect; and, in the absorption of difficultly condensible gases, was repeated at intervals, during a space of from twelve to twenty-four hours. Alterations of the barometer were always observed; and the residuary gas measured, or estimated, at a pressure of $29\frac{1}{2}$ inches.

1. *Absorption of Carbonic Acid Gas by Water.*

That the temperature of water influences the proportion of carbonic acid which it is capable of absorbing, is already known as a general fact *; but the exact amount of this influence has not, I believe, been hitherto ascertained. In the course of a series of experiments to determine it with precision, I was surprised by obtaining results which differed considerably from each other, at the same temperature of the gas and water; when both were, in different experiments, of like purity; and when the barometer had the same elevation. Of the cause of these variations I was not aware, till my friend Mr. Dalton suggested, that they probably depended on the variable amount of the residues; and on repeating the experiments, with different proportions between the gas and the water, this suggestion was fully confirmed. Thus, when two measures of carbonic acid gas were agitated with one measure of water, the absorption was considerably greater than when, to the same quantity of water, a less proportion of gas was used. The cause of this diminished absorption seems to be connected with the proportion of common air contained in the unabsorbed residuum; for, besides the unavoidable contamination of

* See Mr. Cavendish's experiments in the Phil. Trans. vol. LVI. p. 163; and Fourcroy's *Système*, 4to. Tom. I. p. 215.

the gas employed, with a minute portion of the air of the vessel used for its extrication, a small quantity will always be liberated from the water, whatever pains have been taken to deprive it of air, by previous long boiling, exposure under the air pump, or both in succession. That this is the true explanation appears also from the result of adding to the gas a proportion of common air. Thus, when, at the temperature of 55°, 20 measures of carbonic acid are agitated with 10 of water, at least 10 measures of gas are taken up; but, from a mixture of 20 measures of carbonic acid with 10 of common air, 10 parts of water take only 6 of carbonic acid, or 4 less than in the former instance.

An analogous fact was observed by Dr. Brownrigg *, who remarked that gas does not escape from the water which it impregnates, unless the water be in contact with air: for when the Pouhon water was excluded from air, but, at the same time, liberty was given for its gas to arise into an empty bladder, the gas did not spontaneously separate from the water, but, on the contrary, remained united with it when exposed to the greatest heat of our climate. When the impregnated water, he observes, is thus excluded from air, the gas will escape very slowly, at any temperature less than 110° of Fahrenheit, although such heat be sufficient for the distillation of water; nor can it be wholly expelled by a heat of 160° or 170°, continued two hours. But it is well known, that water saturated with carbonic acid gives up its gas rapidly, when freely exposed to the atmosphere.

In fixing the proportion of carbonic acid gas absorbed, it is therefore necessary to note the quantity of residuum, as is done in the following table.

* See Dr. Brownrigg's Paper on the Pouhon Water, Phil. Trans. vol. LXIV.

Experiment

Experiment.	Temperature.	Measures of water.	Measures of gas.	Quantity absorbed.	Residue.	Absorbed by 100 inches of water.
1	55	13	32	14	18	108
2	85	13	32	11	21	84
3	55	13	24	14	10	108
4	55	10	15	10	5	100
5	55	20	20	18	2	90
6	55	19	19	16	3	84
7	85	19	19	13	6	70
8	110	10	20	6	14	60
9	110	20	20	9	11	45

Since the above table was drawn up, I have been gratified by remarking that, in the experiments of Mr. Cavendish, similar variations in the quantities absorbed were produced by the variable amount of the residua; as will appear from the following deductions from his experiments.

At the temperature of 55°.

1. When the gas absorbed was to the residue as 100 to 164, 100 cubical inches of water took up . . . 116

2. When

2. When the absorbed gas was to the residue as 100 to 16, 100 inches of water took up 107
3. The absorbed gas being to the residue as 100 to 10, 100 parts of water absorbed, ... $102\frac{1}{2}$
4. The absorption being to the residue as 100 to $1\frac{1}{2}$, 100 parts of water took up, . . . $95\frac{1}{2}$

The quality of the residuum I only ascertained in experiments 5 and 6 of the preceding table. In experiment 5, the residuary two measures contained $7\frac{1}{2}$ *per cent.* of common air, or 0.15 of a measure. But of those 13 existed previously in the 20 measures of carbonic acid gas; and the 20 measures of water had therefore only given up .02 of a measure, or about $\frac{1}{1000}$ of its bulk. I apprehend, however, that the whole of the common air was not even thus extricated from the water. In experiment 6 the 3 residuary measures contained $\frac{1}{6}$ of common air.

To judge of the influence of temperature, it is essential that the experiments compared should be on similar proportions of gas and water. Thus, from a comparison of experiment 1 and 2, it appears that about $\frac{1}{14}$ of the whole bulk absorbable at 55° is the diminution of the quantity of absorption produced by each elevation of 10° of temperature; and the same inference follows from various other experiments, the results of which I have thought it needless to state *.

* During the absorption of carbonic acid by water, the gas and water having previously the same temperature, there is an extrication of caloric sufficient to raise the temperature of the water between $\frac{1}{2}$ and $\frac{3}{4}$ of a degree of Fahrenheit. The same effect is produced by the condensation of sulphuretted hydrogen and nitrous oxide gases, though less apparently. To perceive this phenomenon, considerable quantities of gas and water should be used.

2. *Sulphureted*

2. *Sulphuretted Hydrogen Gas.*

One hundred parts of water, at 55° of temperature, absorb 86 parts of this gas, obtained from sulphuret of iron and dilute sulphuric acid, a residue being left, equal in bulk to the gas absorbed. At 85°, under similar circumstances, the same quantity absorbs 78.

3. *Nitrous Oxide.*

At 45°, 100 cubic inches of water take up 50 of nitrous oxide; and at 70°, the same quantity takes up only 44. According to Mr. Davy, in whose experiments, from his intimate knowledge of this gas, and skill in its preparation, I place more confidence than in my own, 100 inches of water at 45° take up 54 of nitrous oxide, the residuum being about one half the volume of the gas absorbed.

4. *Less absorbable Gases.*

The experiments with those gases which are absorbed only in sparing proportion by water, I could not conveniently make at more than one temperature; nor indeed did the object appear to me worthy of the time and attention which such a repetition of them would have required. Of the accuracy of the following, however, I satisfied myself, by repeating each two or three times; and with gases of the greatest attainable purity.

100 cubic inches of water at 60° absorb,

Of nitrous gas	5 inches.
Oxygenous gas	2.63
Phosphuretted hydrogen ditto	2.14
Gaseous oxide of carbon	2.01
Carburetted hydrogen gas	1.40
Azotic gas	1.20
Hydrogen gas	1.08

The

The solubility of atmospherical air cannot easily be ascertained; for, as I shall hereafter shew, in a memoir on the expulsion of gases from water by each other, air is decomposed by agitation with boiled water, its oxygenous portion being absorbed in preference.

From the statements given by various philosophers, (the Abbé Nollet, Drs. Hales, Priestley, and Pearson,) of the quantity of air separable from water of different kinds, by heat or a diminished pressure, I expected that a much larger proportion of the gases constituting the atmosphere would have been absorbed by water, than the above numbers assign. It is to be recollected, however, that no method hitherto discovered detaches from water all its air; and the unknown quantity remaining in it, after these modes of separation have been employed, is to be added to that with which a given volume of water can be artificially impregnated. Dr. Pearson, in his enquiries into the nature of the gas obtained by passing electric discharges through water, was at great pains to purify the subject of his experiments from air, by boiling and a powerful air pump; but he always found, that after the full effect of both these methods, electricity liberated a farther, and not an inconsiderable, portion of air *.

Common spring water may, I think, be fairly taken as a specimen of water fully charged with atmospherical air; and, with the view of determining the quantity and kind of gases extricated from it, I made the following experiment. A glass globe, of the capacity of $117\frac{1}{2}$ cubical inches, was filled with water fresh from the well. To its mouth was adapted a curved and stoppered tube, which held $\frac{3}{4}$ of an inch; and this was also filled with

* Philosophical Transactions for 1797.

water.

Fig. 1.

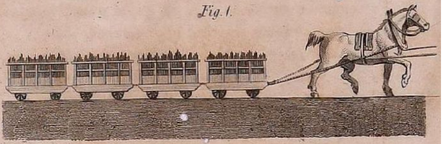
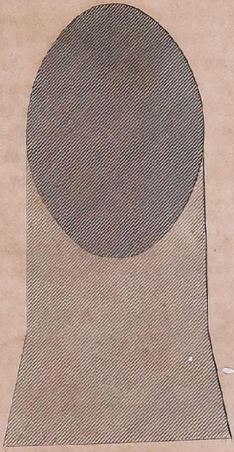


Fig. 2.



water. The globe was then placed in a vessel of brine, which was kept boiling between six and seven hours, and the gases were received over mercury. Their quantity and quality were as follows.

No.	Cub. inches.	Consisted of Carbonic acid.	Air.	Proportion of oxygen gas in the residuary air.
1	1.25	0.50	0.75	0.20
2	1.25	0.85	0.40	0.16
3	1.63	1.23	0.40	0.16
4	0.50	0.49	0.01	lost by accident.
	4.63	3.07	1.56	
Air remaining in the bent tube	0.75			
	5.38, total gas from $117\frac{1}{2}$ inches of water.			

But $4\frac{1}{2}$ inches of water were expelled owing to the expansion by heat. Therefore $117\frac{1}{2} - 4\frac{1}{2} = 113$ inches of water gave 5.38 inches of gas; and 100 inches consequently gave 4.76, of which 3.38 were carbonic acid, and 1.38 atmospherical air. Hence the water afforded about $\frac{1}{70}$ its bulk of atmospherical air, and $\frac{1}{20}$ of a mixture of gases. In this estimate, the gas remaining in the tube is reckoned as carbonic acid, which may be allowed, since the portion last obtained held only $\frac{1}{50}$ its bulk of common air.

SECTION II.

On the Influence of Pressure in promoting the Absorption of Gases; and the Description of an Apparatus for exhibiting this Phenomenon.

For the purpose of determining the ratio between the addition of pressure and the increased absorption of gases by water, I employed the apparatus, with some addi-

tion, which has been already described. The tube B was lengthened at pleasure, with the view of obtaining, by a column of mercury, any additional pressure that might be required. The vessel A. Fig. 1, was then filled completely with mercury, which rose to its corresponding level in the tube B. A given quantity of water, of a known temperature, and afterwards a measured volume of gas, were transferred into the vessel, in the mode already described; and as the mercury, by opening the cock *b*, was brought to the same level in both legs of the syphon, the gas, it is evident, must have been under the ordinary weight of the atmosphere. A quantity of mercury was next poured into the leg B, sufficient to form a column 28 inches higher than the level of the mercury in A, after this addition; and the bulk of the gas was again noted. This was found to be, pretty exactly, $\frac{1}{2}$, $\frac{1}{3}$, &c. of the space occupied before, when one, two, or more additional atmospheres were applied. Brisk agitation was now used, as long as any absorption took place; and into the tube B an assistant poured mercury, so as to preserve in it the excess of 21 inches above the level of the mercury in A. The degree of absorption was known by the scale on A, or more accurately by the quantity of mercury required to support the elevation of 28 inches in B.

By lengthening the column in B to 56 inches, the pressure of two additional atmospheres was obtained; and this was the utmost extent to which the addition of weight could be carried without forcing the joint at D.

When the cock *b* was opened, and the column in each leg thus suddenly fell to the same level, the water, which had been previously charged with gas, under a pressure of three atmospheres, effervesced violently; but some time elapsed before the additional gas, forced in by compression,

pression, was wholly evolved. These appearances are very striking and amusing; and are well calculated for exhibition in a chemical lecture. The apparatus, however, I have no doubt, may be greatly improved; but, at the distance of nearly 200 miles from the metropolis, I was under the necessity of using such an one as could be constructed by my own hands.

A considerable improvement in the construction of the apparatus, which would obviate the expediency of the flexible tube D, would be the following. To the lower neck of the vessel A, Fig. 1, let a cap and cock, with a female screw be cemented; and let the upper end of the pipe C be terminated by a cock with a male screw. Introduce the gas and water in the manner already described; apply the increased pressure; and, having shut the two additional cocks, unscrew them from each other. The vessel A will thus be attached, and agitation may be easily applied; after which again screw it into its former place, and on opening the two cocks the mercury will rise in the vessel A. Supply the descent in B by fresh mercury, and proceed as before, repeating alternately the pressure and agitation as long as any farther absorption takes place.

A farther amendment of the apparatus would consist in the substitution of cocks of some other metal than brass, which, however perfect at first, are always injured by the repeated action of the mercury. If cocks of glass could be ground sufficiently tight, metal caps with screws might be cemented to them.

For observing the increased absorption of less condensible gases, I found it necessary to substitute a vessel of larger size than A, and of the capacity of at least 50 cubical inches. It is represented by the dotted lines in Fig. 1, and was furnished with a cock and screw at c.

 As

As it would have been troublesome to have filled so large a vessel entirely with quicksilver, it was filled with boiled water, with the exception of a quantity of quicksilver rather exceeding the bulk of the gas employed. The gas was admitted, as usual, from a transfer bottle, the mercury which it replaced escaping through the cock *b*. The increased pressure was next applied; and the experiment conducted as before, except that the agitation was much longer continued.

The results of a series of at least fifty experiments on carbonic acid, sulphuretted hydrogen gas, nitrous oxide, oxygenous and azotic gases, with the above apparatus, establish the following general law: *that, under equal circumstances of temperature, water takes up, in all cases, the same volume of condensed gas as of gas under ordinary pressure.* But, as the spaces occupied by every gas are inversely as the compressing force, it follows, *that water takes up, of gas condensed by one, two, or more additional atmospheres, a quantity which, ordinarily compressed, would be equal to twice, thrice, &c. the volume absorbed under the common pressure of the atmosphere.* By frequent repetition of the experiments I obtained results differing a little from the general principle above stated; but, for all practical purposes, I apprehend, the law has been announced with sufficient accuracy *.

In place of the cock *a*, I cemented, in one experiment, a very sensible thermometer. The vessel was next filled with mercury through the cock *b*; and the tube B being also filled, the cock *b* was shut, and a bottle of carbonic acid gas screwed on. The cock *b* being then opened,

* That the facts did not, with invariable accuracy, correspond to the law, was perhaps, in part, owing to the addition of only 28 inches of pressure; when, in strictness, 29½ should have been used, or twice the elevation of the mercury in the barometer, during each experiment.

the

the mercury descended, and a measured quantity of carbonic acid arose into the vessel A. In the same way, a measured quantity of water was introduced. When the density of the air was suddenly doubled by a column of quicksilver, the mercury in the thermometer, whose bulb was still surrounded by the condensed gas, rose about 1½ degree. On agitating the vessel till the water encompassed the bulb of the thermometer, an elevation of barely ½ a degree ensued in the temperature of the water. This ascent would probably have been greater if the evolved heat had not been carried off by the mercury on which the water floated.

Observations on the Culture and Growth of Oak Timber. *By the Rev.* RICHARD YATES, *F. A. S.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was voted to the Author of this Communication.

TO expatiate upon the vast importance of increasing the growth of oak-timber seems unnecessary. The national advantages resulting from this source appear to be in general well understood; and yet the cultivation and management of this most useful plant has not hitherto obtained that degree of attention which it most certainly merits.

Entirely to obviate, or even in some measure to remove or lessen, the obstacles that still continue to impede the planting of oaks, would therefore be rendering an essential service to the nation. The desire of accomplishing

plishing so beneficial a purpose, has induced the judicious and public-spirited conductors of the Society of Arts to propose a premium for "ascertaining the best method "of raising oaks;" in consequence of which, this paper is submitted to their candid consideration. And as the statements here made are founded upon a sedulous and active experience of fifty years, it is presumed the *spirit* and *meaning* of the Society's proposal may have been observed, although it has not been possible (in this instance) *literally* to fulfil its terms; at least, the very intention of promoting and forwarding the views of so enlightened and highly useful a Society, may, it is hoped, be accepted as an apology for calling their attention to these observations.

It forms no part of the present design to enter minutely into the various causes that continue to operate in obstructing the cultivation of oak; as there is one of peculiar magnitude, the consequences of which are highly detrimental and injurious, and which it is therefore the principal object of this paper to remove.

An opinion is generally prevalent, that the oak is particularly slow in its growth, and requires a great number of years before it affords any advantage. This idea too often deters from planting, on account of the very great length of time it is supposed the land must be occupied before any return of valuable produce can be obtained from it, after a considerable expense may have been incurred in forming plantations.

This opinion I consider as entirely founded in error, and to have taken its rise in a great measure from the want of proper management that has hitherto commonly prevailed in the raising of oaks: and in this paper I shall endeavour strongly to state, that the oak may be rendered very rapid in its growth, and that consequently

land

land may be employed to great advantage in its cultivation, as a very considerable and profitable produce may, in a much shorter time than is generally supposed, be derived from proper parts of an estate thus employed.

Oak-timber in this country, for the most part, appears in trees of a considerable extent of head, but seldom more than *twenty* or *thirty* feet in stem; and this, in many instances, the growth of a century. Now, by the course of management here proposed, it is conceived that trees, of at least *double this magnitude*, may be obtained in about half that time.

It is not my intention to attempt a proof of this proposition by theoretical deductions, but to appeal for its confirmation to the indubitable test of fact, which, from the event of repeated trials, impresses a conviction, that experience will be found to support and establish it in the most unequivocal manner.

It would be easy to enlarge much on the various qualities of soil, the nature and process of vegetation, and the peculiar properties of the oak; but as these topics may be found amply and judiciously discussed in many other authors, who have expressly treated on these subjects, I shall decline all such speculations; and, with the hope of being more essentially useful, shall confine myself to a statement as simple and practicable as possible.

The oak, in the progress of its growth, spreads numerous roots near the surface of the ground, and in an horizontal direction: these assist in supporting and preserving the tree in its position, but seem to contribute very little to its increase and magnitude. The oak appears to derive its chief nutriment and strength from a root that always descends at right angles to the horizon, and is called the tap-root. The first thing, therefore, to be observed is, that upon a judicious attention to this peculiarity,

culiarity, the planter's success principally depends; and the neglect of this care is the constant source of error and disappointment. In all climates, and upon all soils, to preserve this tap-root from injury, and as much as possible to assist its growth, is a general, and indeed the most essential principle in the cultivation of oak. With a due regard to this circumstance, the management of a plantation may be resolved into the three following practical directions:

Previously to planting the acorns, *loosen* the earth intended for their reception, by *deep trenching*.

Never transplant, or in any way disturb, the saplings intended for timber.

Keep the plant carefully *pruned*, till arrived at a proper height.

More fully to elucidate the subject, and to prevent the possibility of misapprehension, it may be proper to give a more detailed statement.

In determining on a spot to form a plantation of oaks for timber, it must always be recollected that the plants are to remain without removal in their first situation: the clearing and fencing may then be attended to as usual; and in the course of the winter, from September to March, the particular spots intended for the reception of acorns, may be prepared for that purpose, by digging a trench about three feet in width, and from three to six feet in depth, according to the closeness and tenacity of the soil. If grass-ground, the first spit should be placed at the bottom of the trench; and if more than one trench be necessary, they should be prepared in the same manner, preserving a distance of ten yards between each, if it be intended to employ the intermediate space in underwood, or for any other purpose.

Having

Having made a careful selection of acorns that are perfectly sound, and in good preservation, they are to be planted about the middle of March. Draw a drill in the centre of the trench two inches in depth, if the soil be heavy and loamy, but three inches in a light and sandy earth: in this place the acorns two inches asunder, and cover them carefully with mould. When the plants appear, they must be weeded by hand in the rows, and the earth of the trench round them cleaned with a hoe, once a month during the summer. In October inspect the rows, and thin them by pulling up every other plant: attention will of course be paid to remove the weak and crooked plants, and leave those that are tallest and straightest. On the second year, the operation of thinning must be repeated, at the same time, and in the same manner; and, should any of the remaining plants have made side-shoots stronger than the general character, they must be smoothly cut off with a sharp knife, close to the leading stem. On the third year, the thinning is again to be repeated, and the general pruning commenced, by cutting off close to the leading stem all the side-shoots of the first year; thus leaving the branches of two years to form the head of the following year. The removal of every alternate plant must be continued yearly, till the trees are about thirty feet apart, and which distance they may remain for timber. The pruning is to be continued, by removing every year, very smooth and close to the main stem, one year's growth of side branches, till the plants are arrived at a stem of forty, fifty, or sixty feet, and they may then be permitted to run to head without farther pruning.

The particular arrangement here recommended may be varied according to any peculiarities of situation, re-

gard being constantly had to the general and most important principle of loosening the ground *very deep* previously to planting the acorns. By this mode of culture, oaks may be raised in almost any soil; but, where it is possible, a loam or marl is always to be chosen. Oaks thrive much the best in such earth; and, when assisted by *deep trenching* and *judicious pruning*, attain in a few years to an immense size.

Those who have been accustomed to notice the slow growth and stunted appearance of oak trees, when denied the assistance of art, and left to themselves in the common way, would observe with astonishment the vigorous and rapid increase of plants under the management now pointed out.

The plants thinned out the first three or four years though not fit to be depended upon for timber, as transplanting generally injures very materially the future growth, may be re-planted in the intermediate spaces between the rows, for the purpose of being afterwards removed; or they may be usefully placed in hedges, or other spare and unoccupied spots of ground. They should be headed down at the time of transplanting, as this operation assists the process of nature, in re-producing or remedying any injury the tap-root may have received from the removal: and, if proper attention be given to loosen the soil for their reception, and pruning them as they advance, in most instances an adequate profit will be derived from the labour bestowed upon them. After a few years, the produce of the timber-plantation will be found very advantageous. The young trees that are to be removed yearly, will always find a ready market for a variety of purposes, unnecessary here to enumerate. In addition to these advantages, if by this treatment of *deep trenching* previous to planting, and

annual

annual careful pruning during the growth, timber can be produced in about fifty years, of equal quality, and much superior in size, to that which has been above one hundred years growing under improper management, or without the assistance of cultivation; it will doubtless be allowed that a most beneficial, if not absolutely the best possible method of "raising oaks," is here pointed out and ascertained.

This method of cultivation may perhaps be thought to occasion so much expense in manual labour as to prevent its being generally adopted: it might perhaps be sufficient to observe, that if the work be conducted with judgement and economy, the future produce would afford ample returns for all necessary expenditure: it should also be recollected, that the previous preparation of the ground, and the subsequent pruning of the plants, are both to be performed at that season of the year when a scarcity of work will enable the planter to obtain assistance upon easier terms; with this additional advantage also, of providing employment for the labourer at those times when the general state of agricultural business renders it difficult for him to find maintenance for himself and family without charitable relief.

In 1750, at Ingestrie, in Staffordshire, the seat of Lord Chetwynd, some plantations were formed and managed in a great measure according to the principles here stated, and the growth of the plants was so uncommonly rapid, and so extraordinary, that it could not but attract the notice of all concerned in the conduct of them. The attention to the subject, then excited, has been the occasion and ground of all the observations and experiments made from that time to the present, the result of which is given in this paper.

The extensive plantations of the late Lord Denbeigh, at Newnham Paddox, in Warwickshire, are well known and much admired. The whole has been conducted with great judgement. About a square acre has been employed in raising oaks upon a plan nearly similar to that now proposed, and affords the best and most convincing proof of the superior utility and efficacy of such management. Had the noble earl been now living, I should have been enabled to have laid before the Society some more detailed particulars: that, however, is now impossible; this paper, therefore, in its present state, may perhaps be thought not altogether unworthy of notice, as tending to forward the liberal designs of the Society, and contributing to the advantage of the public, the author conceiving that the best method of raising oaks is ascertained and stated in it.

Should the Society be in any degree inclined to join in this sentiment, it may perhaps induce them to make some alteration in the terms of their proposal; as, according to the statement made in this paper, and indeed from what may be seen in every part of the kingdom, in the character and appearance of oaks growing without cultivation, it seems ascertained, that "acorns set with "the spade or dibble, without digging or tillage," can never be depended on to form good timber; and even in the most favourable circumstance of this case, the growth will be exceedingly slow and precarious. The same may be said of "young plants, previously raised in nurseries, "and transplanted;" for if the tap-root be cut, broken, or in any degree injured, which in transplanting it is almost impossible to avoid, that plant will seldom become a vigorous and flourishing tree. To form a course of experiments on such a plant as the oak, is not a very easy matter.

matter. To fulfil explicitly the conditions of the Society would require a great length of time, and would be attended with considerable expense, from which future candidates may in a great measure be exonerated. The raising even one acre in the manner here ascertained might be productive of great pecuniary advantage, if the facts and experience detailed in this paper are permitted to prove the inutility of the other two methods, and consequently to remove the necessity of employing so much ground upon them, at an expense they will never repay.

On Oil used as a Manure. *By* C. Baldwin, *Esq.*

From Hunter's Georgical Essays.

Having for many years considered oil as the great pabulum of plants, I was much hurt by the result of some experiments, which state oil as *poison*; and turning this in my thoughts a thousand times over, it at last occurred to me, that though oil, as oil in its *crude* state, might act as a poison, yet it might be so changed as to convey it with great advantage to the soil, and I instantly recollected Dr. Hunter's mode by ashes; it also occurred to me that rape-oil cake was known to be an excellent manure, that no objection had ever been made to it but its expensiveness, and that if it was beneficial to the soil, it could only be so from the quantity of oil contained in it, though that quantity must be very small indeed, considering the process of first grinding the rapeseed, and the vast force used to drive out the oil, so that what

what remains is little more than a *caput mortuum*; yet the cake formed of these very remains is known to be a rich manure.

Think for a moment from how many seeds, plants, shrubs, and trees, we draw oil; from rapeseed, linseed, mustard, fennel, aniseed, juniper, carraways, mint, olives, &c. Thus we evidently draw an immense quantity of oil from the earth, but when and how do we convey any to it? I know of little or no attention paid to this circumstance in our compost dunghills, so that all the oil conveyed to them can only be from animal dung.

Whatever may be the quantity of oil remaining in *each* rape-cake, and I believe that no one will state it at half an ounce each, yet it must be remembered that after all it is only a *vegetable* oil; reflecting on this circumstance, and fully persuaded that *animal* oil must be much superior to it, I directly went to town to inquire the price of whale or train oil, and there I was informed, that it was about 2*s.* 8*d.* *per* gallon; this I considered as too expensive; but, pursuing my object, I was informed by Mr. Wilfred Reed, oil merchant, in Thames-street, that he could supply me with bottoms or foots of oil, and a rich thick South Sea whale oil, at 14*d.* *per* gallon.—This was the very thing I wished for, and directly ordered sixty gallons, for a five-acre field, and thus went to work. Having a platform or bottom of twenty load of mould with eight load of dung on it, I carried on three load of light sandy mould, and one load of brick and mortar rubbish, ground fine, and having mixed these well, and made a kind of dish of it, about five feet wide and ten feet long, with a ladle we put over it one half of the oil.—It was in August, and the warmth of the sun soon made the thick oil soak into this compost, when it

was

was directly thrown up in a heap, broke down again, and by five or six turnings, well mixed together, and left in a heap two days, when it was spread equally over the whole dunghill; twenty load more of good mould was then carried on, eight load of dung, and the remaining thirty-gallons of oil were mixed as before, in sandy mould, and brick and mortar rubbish, and equally spread over, and the whole was covered by trimming the four sides of the dunghill, and throwing it on the top.

Thus the dunghill lay more than two months, when it was cut down by mattocks, carefully broke, well mixed, and turned over. The end of March it was carried on the field, spread, and ploughed in; it lay about a fortnight, was then ploughed again, and, on the 22d of April last, it was drilled with the Rev. Mr. Cooke's most excellent drill; I mean his last, with hoes and scarifiers, which I think much superior to his former one: the last I think every farmer, who has seen it at work, will consider as incapable of further improvement. The field was drilled with barley, two bushels to the acre; the crop came up in a most even and beautiful manner; every seed was up within forty-eight hours of each other; all was ripe at the same time, and, from a couple of months after seed-time to harvest, was rated by all who saw it, and it was seen by many, as a sixty bushel crop.

At harvest, three rows were cut across the field, directly thrashed and measured: one load out of thirteen was also thrashed and measured, and both stated the crop to be sixty bushels, but, to wave all possibility of dispute or doubt, I am content to state the crop at seven quarters *per* acre.

As to the quality of the barley, I could here cite the opinion of one of the most eminent brewers in London, who

who saw the crop growing, and declared he would readily give 1000*l.* to be assured that all the barley crops in the kingdom were of equal burthen and weight; five quarters of it have been lately sent to Nethrapps, in Norfolk, as seed-barley, under the denomination of 15 comb-barley; and an eminent maltster tells me, it weighs 220 lb. *per* sack, or 55 lb. *per* bushel, Winchester measure.

Among the many gentlemen and farmers who saw the crop on the ground, was the celebrated Mr. Bakewell; he came with three or four others, and, walking down the field, observed the hedge and bank; the bank, upon being touched with a stick, run down as sand and gravel generally do, and Mr. Bakewell being asked his opinion of the value of the land, if I do not mistake, valued it at 18*d. per* acre, but turning to the crop, and desiring his friends to do so also, he admitted that it seemed as if growing on land of 15*s.* or 20*s. per* acre.

I must not omit saying that the barley followed oats, upon a lay of six years old, that the land was, as is too common in such cases, much infested with the little red or wire worm, and that the oats suffered much from them; when we were ploughing for the barley the first time, I observed many turned up by the plough, when a distant ray of hope instantly darted upon my mind, that the oil in its then state, or from its strong effluvium, might prove obnoxious to them, and I am happy in saying, that the barley did not suffer from them in the least.

I can, however, add here, that I am now trying that experiment in Hampshire, having last autumn made up dunghill, with twenty gallons of oil, on one-third of it, for a six-acre field, which is now drilled with pease.

It

Page 255.

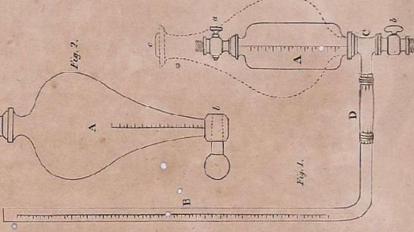
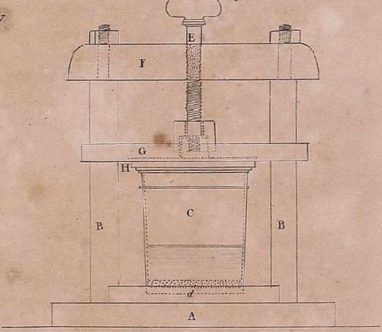
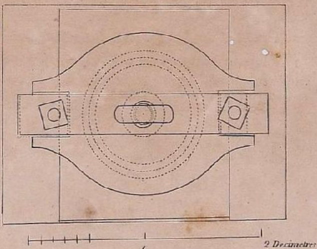


Fig. 3.

Page 267.



Plan



It is well known that all animal substances, in a state of corruption, wonderfully promote vegetation, and are the actual food of plants.

The whale-oil which I used is an animal substance, perhaps the richest part of the animal; whether I used enough, or what is the proper quantity *per* acre, experience must point out. Say I used eight loads of mould, three or four loads of dung, and twelve gallons of whale-oil, *per* acre.

That oil applied to land, as a food for plants, in its crude state, acts as a poison, I cannot deny, but my process is very different; I believe that oil, particularly animal oil, is the pabulum of plants, that is, oil subtilized by the salts in a compost dunghill, left there a considerable time, in a state of putrefaction, and until the whole is become putrescent, *then*, I say, I *believe*, I have got the best and richest manure that can be carried on land.

The barley evidently proved its excellence; a ridge of summer cucumbers, in my garden, pointed out to many its great power, the leaves being in general from ten to ten and a half inches broad, and the vines occupied an uncommon space of ground. Five hundred cabbages and savoys, planted by the side of four thousand more, and which had only one handful of the oil manure put into each hole made by the dibble, at the time of planting, were evidently near as big again as the others.

On the most profitable Method of managing Light Arable Lands. By the Rev. John Buxton.

From Hunter's Georgical Essays.

A JUDICIOUS course of crops constitutes a most essential part of an arable farm. The following is practised in Norfolk, a country remarkable for the best courses.

First Year. —— Turnips.

1. Plough the stubble up about Christmas.

2. The beginning of March, plough again and harrow.

3. The beginning of April, plough and harrow; but before you begin to plough this third time, spread twelve loads of good manure upon each acre.

4. Plough again a fortnight before Old Midsummer; then sow your turnip-seed, two pints to an acre, and harrow it in. — Hoe the turnips twice.

Second Year. —— Barley and Clover.

Get the turnips off the beginning of March — plough and harrow. Three weeks after, plough and harrow again. The latter end of April, or beginning of May, plough the third time; but before you begin to plough, sow half of the seed upon the land, namely, a bushel and a half *per* acre, then plough and sow the same quantity of seed above furrow. Harrow once; then sow ten pounds of good clover-seed, and let the barley and clover be harrowed in together.

Third Year. — Clover.

Take two crops of clover; or, if you think proper, reserve the second crop for seed.

Fourth

Fourth Year.—Wheat.

A fortnight or three weeks after Old Michaelmas plough your land. As soon as ploughed, throw two chaldrons of hot lime upon each acre. Harrow the lime and the seed in together. Provided the land be clean, I think two bushels of wheat or barley sufficient seed for an acre.

Expense of the Turnip Crop.

	£.	s.	d.
For ploughings and harrowings, at 3*s.* 6*d.* each,	0	14	0
Twelve loads of manure, and carriage, at 5*s.* *per* load,	3	0	0
Seed, two pints, 1*s.* Hoeing twice 7*s.*	0	8	0
	4	2	0

Expense of Barley and Clover.

	£.	s.	d.
Three ploughings and harrowings, at 3*s.* 6*d.* each,	0	10	6
Seed, two bushels, 5*s.* Clover 10*s.*	0	15	0
Reaping 1*s.* 6*d.* Beer 1*s.* 6*d.* Getting in 5*s.*	0	8	0
	1	13	6

Expense of the Clover Crop.

	£.	s.	d.
Cutting and beer 2*s.* Making 1*s.*	0	3	0
Carrying 5*s.* Second crop 7*s.* 6*d.*	0	12	6
	0	15	6

Expense of the Wheat Crop.

	£.	s.	d.
Ploughing once and harrowing, ...	0	4	0
Lime, two chaldrons, 1*l.* Carriage 10*s.* . .	1	10	0
Seed, two bushels, ...	0	10	0
Reaping 6*s.* Beer 1*s.* 6*d.* Carrying 5*s.* . .	0	12	6
	2	16	6

Expense of the Four Years.

	£.	s.	d.
Turnip crop, ...	4	2	0
Barley ditto, ...	1	13	6
Clover ditto, ...	0	15	6
Wheat ditto, ...	2	16	6
	9	7	6
Nine pounds seven shillings and sixpence, for four years, makes each crop, upon an average, ...	2	6	10½
Add rent 1*l.* Tithes and rates 7*s.* 9*d.*	1	7	9
Rent, rates, and cultivation *per* acre, ...	3	14	7½

Profits of Four Crops.

	£.	s.	d.
Turnip crop worth, ...	3	0	0
Barley ditto, 36 bushels, at 2*s.* 6*d.*	4	10	0
Clover ditto, first crop, three loads, . . .	3	0	0
Second ditto, two loads, ...	2	0	0
Wheat ditto, 28 bushels at 5*s.*	7	0	0
	19	10	0

Nineteen

	£.	s.	d.
Nineteen pounds ten shillings makes each crop upon an average, ...	4	17	6
Profit *per* acre, ...	4	17	6
Expenses, ...	3	14	6
Clear profit *per* acre . .	1	3	0

Lands cultivated in this manner will never be overrun with weeds; neither can the ground be distressed, as tap-rooted plants regularly follow such as spread their roots superficially.—The system is founded on reason, and supported by experience. Nice farmers dibble in the wheat, dropping three grains into each hole. For this practice a clover lay, after one ploughing, is the most favourable.

Account of the Penrhyn Iron Railway.

Communicated by the Inventor, Mr. Benjamin Wyatt, *of Lime Grove, near Bangor.*

With a Plate.

THE following account of the Penrhyn railway, with the section of the rail, will, I flatter myself, be acceptable to many of your readers. The rail hitherto made use of in most railways is a flat one, three feet in length, with a rib on one edge, to give it strength, and to prevent the wheels (which have a flat rim) from running off. Observing that these rails were frequently obstructed by stones and dirt lodging upon them; that they were obliged to be fastened to single stones or blocks on account

count of their not rising sufficiently high above the sills, to admit of graveling the horse-path; that the sharp rib standing up was dangerous for the horses; that the strength of the rail was applied the wrong way; and that less surface would create less friction; led me to consider if some better form of rail could not be applied: the oval presented itself as the best adapted to correct all the faults of the flat rail, and I have the satisfaction to say that it has completely answered the purpose in a railway lately executed for Lord Penrhyn, from his lordship's slate-quarries, in Carnarvonshire, to Port Penrhyn, (the place of shipping.) The wheel made use of on this rail has a concave rim, so contrived in its form, and the wheels so fixed upon their axes, as to move with the greatest facility in the sharpest curves that can be required. It is plain, by inspecting the section of this rail, (see Plate XI. Fig. 1,) that no dirt can lodge upon it; that it must be stronger than any other form of the same weight, to resist both the perpendicular and lateral pressure; that it must occasion very little friction; that it presents no danger to the horse; and that it may be placed upon the sills, so as to admit of a sufficient quantity of gravel to cover them. These advantages have so forcibly struck all who have seen and examined this road, that I have been induced to lay it before the public through the medium of the Repertory of Arts and Manufactures.

The Penrhyn railway is six miles and a quarter in length, divided into five stages. It has three-eighths of an inch fall in a yard, with three inclines, was begun in October 1800, and finished in July 1801.

On this railway two horses will draw twenty-four waggons one stage six times a day, and carry twenty-four

four tons each journey, which is 144 tons *per* day. This quantity used to employ 144 carts and 400 horses; so that ten horses will, by means of this railway, do the work of four hundred.

I am, &c.

BENJAMIN WYATT.

REFERENCES TO PLATE XI.

Fig. 1, shews the kind of carts used on this railway.

Fig. 2, section of the railway, full size, four feet six inches long; weight thirty-six pounds. The part below the oval is cast to each end of the rail three inches long, to let into the sills, which have a dove-tail notch to receive them.

New Observations on the Use of Acid Fumigations to purify the Air, and stop Contagion; and the most simple Method of producing that Effect. By M. GUYTON.

With a Plate.

From the ANNALES DE CHIMIE.

THE bottles for purifying infected air, and preventing contagion, are become so common, that they may be had ready-made at the shop of M. Boulay. Nothing can be conceived more simple than the method of preparation, more convenient for common use, or less expensive, on account of the property which this composition possesses of preserving its virtue for a great length of time. I have one of these bottles, prepared almost twelve years ago, and which, the moment it is opened, emits a strong smell of oxygenated muriatic acid gas, though it has

has served me on a great number of occasions, and nothing has been added to it since its preparation. Such is the property of what I have denominated extemporaneous oxygenated muriatic acid, because it is made in an instant, without any distilling apparatus, by simple mixture.

Though the operation is in itself so very easy, yet there are nevertheless proportions to be observed, that the disengagement of gas may be sufficiently abundant to be efficacious, and not so rapid as to injure the vessels; and it is obvious that in these cases, that attention should be paid not only to the quantity, but still more to the state of concentration of the acids.

Several persons having seen the stoppers fly out of the bottles of themselves, were alarmed, and mentioned it to M. Boulay; he thought the best mode of correcting this inconvenience would be to dilute the mixture, in order to weaken it. Soon after I was informed that bottles lately purchased emitted scarcely any smell when held to the nose, and was even shewn some that had but a very slight smell of ordinary muriatic acid. In conformity with the advice I instantly gave to M. Boulay, he took precautions that all his bottles should have the necessary degree of strength, and I know that those which he has since sold have been properly made up. These circumstances caused me to think that it might be useful to determine, with greater accuracy than I had yet done, the process, by which I mean the proportions both of weight and bulk, to produce a liquor that may always be regulated at pleasure, and preserve its strength. I shall proceed to give the receipt with all its details.

The bottles to be employed for this purpose should not exceed the capacity of $4\frac{1}{2}$ centilitres, or 45 centimetres, (about $2\frac{3}{4}$ cubic inches). This is the size of those prepared

prepared by M. Boulay; he fixes them in a case of hard wood, generally box, of neat workmanship. This box shuts by means of a screw. It is unnecessary to observe, that the stopper of the bottle should be of glass ground so as to fit exactly.

When you have selected a bottle, measure its capacity. Supposing it to be 45 cubic centimetres, put into it 3 grammes of black oxyd of manganese pulverized, not reduced to fine powder, but merely passed through a hair sieve. Add 7,5 cubic centimetres, or $\frac{1}{4}$ of a centilitre, (about $\frac{1}{3}$ of a cubic inch,) of pure nitric acid, the specific gravity of which is 1,134, (about 17 degrees of Baumé's areometer). When the stopper is put in, the operation is finished.

It will be observed, that there remains in the bottle a vacancy of about two-thirds of its capacity; this is a material point, without which it cannot possibly contain the gas. Having once exceeded this proportion in a very strong bottle of flint-glass, of the capacity of 4 decilitres, the stopper weighing 122 grammes was projected to such a height that it broke the bottle in its fall; but by observing the above proportions, all accidents may be prevented.

It would be adviseable to accompany these bottles with a short instruction how to use them, the knowledge of which only gives a value to any object.

It must be premised, that the screw of the wooden case is intended only to keep the glass stopper in its place, which would otherwise be expelled by the expansion of the gases, and would suffer the acid to escape; so that if this screw be turned too far, the top of the case must consequently be split, or the neck of the bottle broken, which would be attended with danger if not immediately perceived.

 I have

I have observed that the first motion of those unacquainted with the nature of acid gases, is to lift the bottle to their noses as they would a common smelling bottle, which produces an irritation the more painful the more speedily it is raised to its maximum. It is therefore of some consequence to inform them, that the bottle should never be held near that organ; that, on the contrary, it should be placed at a distance from it when the stopper is taken out, and that it is time to put it in again when the olfactory nerves begin to be affected by the gas, excepting the fumigation be intended to act in a given space, as in purifying a room infected with putrid exhalations; in which case the bottle is placed on a table, where it is left open for some minutes. With attention to these points, the whole effect is obtained without incurring the smallest inconvenience.

Permanent Apparatus for purifying the Atmosphere of Hospitals, or Places of Public Resort, &c.

In an account of the numerous experiments which I made during one of the hottest summers, on considerable volumes of air infected by putrid matters, I have stated that I took the precaution to keep in my laboratory a very large bottle, containing the above-mentioned mixture, for producing oxygenated muriatic acid gas. This bottle had been left there, and fell into my hands a few days ago, when I was surprised, upon opening it, at the strength of the gas it contained after an interval of two years. I was convinced that this mixture, put in sufficient quantity into larger vessels, might be substituted for all kinds of disinfecting fumigations, and fulfil the object as completely without trouble, expense, inconvenience, or even the necessity of renewing the preparation, if not after too great length of

of time, and even if the occasions for giving vent to the gas should have been very frequent.

It is plain that the capacity of the vessel must be proportionate to the extent of the space to be purified, and its opening sufficiently large to emit instantaneously the requisite quantity of gas; that is, enough to reach every where without too powerfully affecting those who are nearest to it. It is necessary that the gas should be confined in such a manner as not to escape even imperceptibly, but that its exhalation should be limited to such times and quantities as we please, and remain whole months without its pressure being in the least suspected.

All these conditions may very easily be obtained even for the largest ward of a hospital, by the means I am about to describe.

Take one of the jars, of very thick flint glass, that may be procured in any of the shops, 11 or 12 centimetres in height, and 10 in diameter, of the capacity of 7 decilitres, (about 35 cubic inches). The edge must be prepared to receive a cover formed of a flat plate of glass. The bottom of the jar is fastened to a board, made to slide horizontally in the grooves of two side pieces. These sides support a covering, through which passes a screw that serves to lift off or put down the cover of the jar by means of a nut fixed to a moveable piece.

A reference to Plate XII. Fig. 3, will explain the form and dimensions of this simple apparatus, which may be entirely of wood, without iron or any other metal; the construction is within the comprehension of the meanest capacity, and is far from being expensive.

The vessel being thus disposed, and admitting its capacity to be 7 decilitres, there must be poured into it successively a decilitre of nitric acid, at the degree of

 concen-

concentration above mentioned, and a dicilitre of muriatic acid; to these must be added 40 grammes of black oxyd of manganese pulverised, and the vessel must be immediately closed by pressing down the cover. These proportions are given on account of the necessity of leaving at least two thirds of it empty.

If the infection is powerful, or if the places from which it proceeds are so numerous as to renew it from time to time, it would be advisable to have two or three of these apparatus in different parts of the ward.

In an apartment of less extent than that here supposed, for instance in one containing only ten or twelve beds, or in places of resort, where the air is vitiated only by a momentary accumulation of animal effluvia, instead of the above vessel, one of those bottles, with a very wide neck, for the use of laboratories, may be employed; their capacity is generally from 40 to 45 centilitres; and their necks are 3 centimetres and upwards in diameter.

It will instantly occur, that by putting into one of these bottles 6 centilitres of each of the two acids and 24 grammes of black oxyd of manganese, a supply of anti-infectious gas is procured in the most simple manner. The only cause of apprehension here, and which is removed by the apparatus, is that the stopper being kept down only by its own weight, might be forced out by the expansion of the gas; but, to prevent this accident, nothing more is necessary than to fasten a lump of lead to the stopper.

The only instruction to be given relative to the manner of using these reservoirs of anti-infectious gas, is to open them when thought proper, and to shut them as soon as those nearest them begin to be affected. The expansion of the portion of gas emitted follows of course, and the effect is such, that if the vessel remains open only

only four or five minutes, those who enter an hour afterwards at the farthest door from it will immediately perceive that there has been a disengagement of oxygen gas.

It will doubtless be admitted, that of all the processes for acid fumigations, this is the most simple, the least liable to accidents, and the best calculated for common use. Every one who considers that the gas thus produced is acknowledged to be the most efficacious even by those who seemed to doubt its activity before the means of regulating it at pleasure were discovered; in a word, every one who adopts the decided opinion of many professional men, that this gas excels all others in the property of exciting the vital powers, must agree with me, that when petty passions are exhausted in opposing the evidence of facts, the superiority of the oxygenated muriatic acid gas, as a purifying and anti-contagious gas, will be established, and that its extemporaneous preparation will be the common prescription for the preservation of health.

References to Plate XII.

A, (Plate XII. Fig. 3,) a flat piece of wood, on which are fixed the two uprights B, B.

C, a glass jar, glued to a small moveable board *d*, which slides into the grooves of the two uprights.

E, a wooden screw, passing through the cross-bar F, and fastened at its extremity to the moveable horizontal piece G, which slides up and down the two upright pieces. H, a glass plate, serving for a cover, and glued to the lower surface of the moveable piece G.

New Process for saturating Potash with Carbonic Acid. *By* M. Curaudau.

From the Annales des Arts et Manufactures.

THE following process for saturating potash with carbonic acid is very simple, and cannot be too widely diffused, as carbonate is so generally employed in the arts. The apparatus and process of M. Welter to saturate potash with carbonic acid, and to procure carbonate of potash of a certain quality, are expensive, and cannot be employed in operations on a large scale. It was with the intention of correcting these inconveniencies that M. Curaudau directed his researches to the means of forming this combination by easy, expeditious, and economical processes.

We shall not here enter into any details on the different purposes for which potash is used; suffice it to say, that the results obtained from it vary according to its greater or less degree of purity, and that in commerce it is difficult to find two samples of the same quality. They differ either in appearance, in the proportions of carbonic acid and the different saline substances intermixed with them, either by nature or art. It is in general very difficult to judge of the quality of potash by mere inspection, and by the taste; for, by trusting to them, the most experienced purchaser is frequently deceived.

It is therefore to be wished, that this substance could be procured in commerce of an invariable degree of purity: the advantages that certain arts would derive from it would soon cause it to be preferred to those crude kinds of potash which very often occasion considerable losses when

when they are always employed in equal quantity. It must be observed, on this occasion, that the good quality of potash is sometimes as prejudicial in certain operations as that of inferior quality is inefficacious. In the former case it acts too powerfully upon the substances submitted to its action on account of its causticity: and in the latter its effects are so weak that the artist is most frequently obliged to recommence the same operation several times. These inconveniences prove how necessary it is to be acquainted with the nature of substances that are employed, particularly in operations whose results vary according to the greater or less quantity of the same substance.

An additional obligation will be conferred upon the arts by chemistry, if, by means of that science, they can be furnished at a fixed price with the potash they require in such a form, that the purchaser can no longer be deceived.

M. Curaudau hopes that his process may produce this effect. I invite chemists, he says, to assist me in shewing the necessity of introducing into commerce the carbonate of crystallized potash.

The method by which I succeeded in abundantly obtaining carbonate of potash in crystals, is the result of those fortunate applications which chemists are enabled to make by the aid of chemical affinities. This process is too simple for me to make a merit of it as a discovery; I sincerely think that if it has not hitherto been known, it is because chemists have not had occasion to devote to it such serious attention as I have done.

Process.

After dissolving, in a sufficient quantity of boiling water, as much potash as is necessary to saturate it, incorporate

porate with it dried tan * till all the liquid is absorbed, and till the mixture resulting from it appears pretty dry. Fill a crucible with this composition, cover it with a lid, and lute the interstices.

This crucible must be submitted to the action of a reverberating furnace about half an hour, or till it is red-hot: when the crucible is cold, pour upon a filtre all the matter contained in it, levigate it with a sufficient quantity of water to purify it quickly; afterwards evaporate the liquor to a very small quantity, and after it has been left to cool about twenty-four hours, it will furnish very beautiful crystals of carbonate of potash †.

When the evaporation has been continued rather too long, and in operations on a large scale, the crystallization begins at 20 or 25 degrees of heat; which proves that evaporation is a method of obtaining this saline substance in very large masses, and regularly crystallized. The figure of these crystals varies, according to the greater or less degree of concentration of the ley, and according to the circumstances attending its cooling. A quantity of ley, evaporated to a pellicle, and cooled according to the principles of crystallization, furnished quadrangular pyramidal crystals, the points of which were extremely sharp, and whose base was covered with other crystals, in the form of a lozenge. These crystals, submitted to the contact of the air, attract a small degree of humidity.

* I mention tan, because it is the most common and least expensive material: bran, saw-dust, and charcoal-powder, afford the same results.

† I must observe, that it is infinitely more advantageous to perform the operation on a large than on a small scale; the rapidity with which small quantities cool, frequently prevents the formation of regular crystals.

After

After all the carbonate which the ley held in solution has been obtained by several evaporations and crystallizations, the mother water may be submitted to calcination with tan, and by this second operation a fresh quantity of crystals of carbonate of potash will be obtained. As it frequently happens that the liquor at length becomes more surcharged with other salts than with potash, it may be evaporated to dryness, and the residue may be employed in making nitrate of potash.

Theory of the Process.

The theoretic part of this operation agrees exactly with what is already known concerning the phenomena of the decomposition of water; and indeed, when the mixture has acquired sufficient heat to decompose the water which it still retains, abundance of carbonic acid is formed by the immediate combination of the oxygen of the water with the carbonate. It is under these circumstances that the potash becomes saturated with carbonic acid; which, at the moment of its formation, comes in contact with every particle of the alkali. While this takes place, a great quantity of hydrogen is disengaged, and is seen to burn round the interstice between the crucible and the cover.

Experiments on the Substance vulgarly called Gum Kino.
By M. VAUQUELIN.

From the ANNALES DE CHIMIE.

THE appellation given to this substance does not at all agree with its nature, and it could scarcely be conceived why it should be called gum if it were not almost always the case, that objects receive names before they are known; for it possesses neither the physical nor the chemical properties of that substance.

We do not yet know for certain what country and what kind of tree produce the gum kino. The English brought it to Europe, and made it an article of commerce by announcing its medicinal properties.

It is called in trade the *kino*, or *gum resin of Gambia*. It was pronounced to be real gum senegal by Dr. Oldfield, who made the celebrated Dr. Fothergill acquainted with it. But, in the *Medical Observations and Enquiries*, we find that the tree which yields the gum kino is called by the natives of the country *Pau de Sangue*, and that it is brought hither from Africa.

It is employed in medicine under the form of boluses and lozenges, composed of sugar, infusions of water and alkohol, as an astringent and tonic medicine for weakness of the stomach, flux, dysentery, and obstinate diarrhœa.

Gum kino has a colour which appears black when seen in a lamp, but it is actually a reddish brown; its taste is bitter and astringent, and it has scarcely any taste. It is brittle, and may be reduced to powder; its fracture is smooth, resembling that of glass, and it becomes rather soft by the warmth of the hands.

When

When submitted to the action of fire it is rendered liquid, and bubbles considerably: it yields at first a clear liquor, but which appears coloured in a few moments; it is then converted into a white light oil, which acquires a colour in the course of the operation, and becomes heavier than the aqueous product. By this decomposition of the gum kino a small quantity of carbonic acid and much carbonated hydrogen gas are formed.

The oil resulting from this operation unites with caustic fixed alkalis, and produces a dark red liquor, which becomes of a dull green in the air.

The aqueous product is not acid, it has a sharp and acrid taste, arising from a portion of oil, which it holds in solution; the potash likewise separates from it a great quantity of ammoniac, which is probably united to the carbonic acid.

1. Out of twenty grammes of this substance, distilled by a powerful heat, were left eight grammes and a half of charcoal of great bulk. This charcoal, when incinerated, produced seventy-two centigrammes of ashes, formed principally of lime, silica, alumine, and oxidated iron.

2. Gum kino is but little inclined to dissolve in cold water, but is much more so in hot; yet even in this there is a portion which does not dissolve, and of which I shall speak presently.

3. The solution of gum kino is slightly acid; for when it is sufficiently diluted with water, and tincture of turnsol is gently poured upon it, you see it turn red as fast as it mixes. The alkohol does not precipitate this solution, but only separates some reddish flakes.

When made with boiling water, it becomes turbid as it grows cold, like a decoction of quinquina; the matter which it deposits is of a reddish brown.

 4. This

4. This solution, a little concentrated, is abundantly precipitated by alkaline carbonates, but the precipitates may be again dissolved by a great quantity of water.

It is likewise precipitated by caustic alkalis, and an excess of those matters redissolves the sediment, and at the same time gives it a more solid red colour.

5. Animal glue, dissolved in water, forms a very considerable coagulum of a rose colour, in the solution of gum kino; if a sufficient quantity of those matters has been employed to saturate each other, the liquor above the precipitate remains almost colourless.

6. Though these effects seem to indicate presence of tannin in gum kino, yet it does not precipitate ferruginous salts black, but, on the contrary, of a dark green, which is not sensibly affected by the air.

This property gum kino possesses in common with infusions of quinquina and rhubarb, from which it appears probable that those three substances contain a principle of the same nature.

Be this principle what it may, it is of a very destructive nature; for, if you pour upon the precipitate which it forms with iron a small quantity of oxygenated muriatic acid, it loses its colour, is dissolved, and is not restored by the addition of an alkaline carbonate; you have then only a red oxyd of iron.

7. The solution of gum kino abundantly precipitates acetite of lead of a yellowish-grey colour, nitrate of silver of a reddish yellow, and that of antimony of a yellowish white, but in much greater abundance than infusions of tan and of quinquina, which appears to shew that it would be a better antidote in cases of poison by that metallic salt.

8. Concen-

8. Concentrated sulphuric acid precipitates the solution of gum kino in great quantity: in proportion as the mixture grows cold the matter combines in a tenacious and ductile mass, which resembles a resin mollified by heat. This effect takes place almost in the same manner in an infusion of gall nuts, into which has been poured sulphuric acid.

Nitric acid likewise forms a precipitate, but in much less quantity than sulphuric acid.

It is rendered turbid by oxygenated muriatic acid, and a pellicle is formed on its surface, which in a little time acquires a very firm consistence.

9. As solution of gum kino forms, as we have seen above, a green precipitate with iron, I was desirous to ascertain whether it would dye stuffs that colour. To this end I boiled wool and cotton in this solution, and afterwards plunged them into liquor of sulphate of iron. At the moment of their immersion they assumed a bottle-green colour; but, by washing and desiccation, this colour changed to a blackish brown: it is very solid.

10. Heated alcohol very easily dissolves gum kino; the solution is dark brown, is rendered rather turbid by water, but forms no precipitate. There is however a small quantity of matter which remains undissolved, and of which I shall speak in the sequel.

11. The solution of kino in alcohol, diluted with water, produces, with re-agents, the same phenomena as the solution in water; namely, with iron a green precipitate, and a white one with silver, lead, and antimony; which proves that the principle which determines these effects is soluble in water and in alcohol.

12. The mixture of gum kino and alcohol, evaporated to dryness, leaves a black, dry, and brittle matter, of which

which water dissolves but a small portion: boiling water likewise dissolves much less of it in proportion than of the entire gum. We shall see farther to what cause this difference is owing.

13. When the alkohol appeared to dissolve no more of the gum kino, with the assistance of heat, I submitted the residue to some experiments to ascertain its nature; it formed almost one-fourth of the gum that had been used.

1. It had no bitter nor astringent taste like gum kino; it was on the contrary mild, and appeared to be mucilaginous. 2. It dissolved readily in hot water, and communicated to it a beautiful red colour. 3. It was not precipitated either by glue or any metallic solution, but it was by alkohol. It had therefore been deprived by the alkohol of the matter which produces the effects noticed above.

4. This matter in burning emits a smell similar to that which proceeds from gums treated in the same manner; from which it appears to be of the nature of gum, but it differs from common gums in the red colour, of which alkohol cannot deprive it.

I suspect that the presence of this substance in gum kino promotes the solution in water of the principle which is soluble in alkohol; for the latter, separate, appeared to me much less soluble than when it is mixed with the gummy part; and, on the other hand, I observed that if the quantity of hot water necessary for the solution of the astringent part be not employed at once, the remainder requires a larger quantity in proportion of that fluid.

For 100 grammes of gum kino I took above 4 litres of water, at different times, without being able to dissolve it intirely;

intirely; there remained about 20 grammes, or $\frac{1}{5}$. This residue became soft with the heat of boiling water, like a species of resin, which is not the case with the intire gum.

A great part was dissolved by alkohol, to which it communicated a red colour, and all the properties which we have already found in the astringent matter.

After thus treating the gum kino with water and with alkohol, there remained only 7 decigrammes, which however were not entirely exhausted of vegetable matter; for alkalis extracted from it a very beautiful and very deep red; and, on the other hand, in burning it emitted an acrid smoke, almost like that of wood. After combustion it left some reddish ashes, composed of silica, lime, and oxyd of iron.

14. Sulphuric acid, diluted with a large quantity of water, and aided by a gentle heat, reduces gum kino to a ductile pitch-like substance, the liquor is of a red colour, but clearer and more lively than that of the aqueous infusion of gum kino. Thus it appears, that instead of augmenting the dissolving power of water, the sulphuric action on the contrary diminishes it; for, if alkali be poured into this liquor, it forms no precipitate. Thus this substance differs from the resinous portion of quinquina, which is much more soluble in acidulated than impure water, and is afterwards precipitated by alkaline carbonates.

Upon the matter, thus treated with diluted sulphuric acid, were formed, in the course of a few days, a great number of small crystalline needles, perfectly white, which, upon examination, exhibited all the properties of sulphate of lime. Thus, there is some portion of lime in this vegetable matter.

As

As the solution of gum kino abundantly precipitates the solution of glue, and as it appears to possess a great number of other properties analogous to those of tannin, I was desirous of trying whether skins might be tanned with it. I therefore prepared a piece of ox-hide in the usual manner, put it into a weak solution of gum kino, and left it there eight days.

I soon perceived that the colour of the solution lost its intensity, and that the colour of the skin became darker in the same proportion. I likewise remarked, that the solution had become turbid, and had deposited a great quantity of yellow flakes. This effect I imagine must have been produced by a remainder of sulphuric acid with which I had swelled the skin, and which had not been carried away in washing.

When the action of the skin upon the solution appeared to have ceased, I put it into another portion, stronger than the former, in which I left it twenty days. At this period the skin had acquired a dark fawn-colour; and, when cut, it might be seen that the tannin had already penetrated above a line in depth. It had likewise acquired great firmness and consistence; it was no longer soft and semi-transparent, as when first put in.

Conclusions.

From what has been stated in this notice concerning the properties of gum kino, it appears that this substance is in a great measure composed of tannin, and is not a gum, as some have supposed, nor a gum-resin, as others have imagined.

If this matter should become more abundant and cheaper, it might therefore be employed for those purposes for which the vegetables called astringent are used.

I must

I must, however, observe, that there is a great difference between its tannin, and that contained in gall-nuts and oak-bark, because the latter precipitates solutions of iron of a black-blue, while, on the other hand, the solution of gum kino precipitates them green; a colour which, when applied to stuffs, changes to a blackish brown by contact with the air. It bears a much greater resemblance to that found in quinquina and rhubarb, for the infusion of those substances likewise precipitates iron green.

New Process for making artificial Alum without the Assistance of Evaporation.

By M. CURAUDAU.

From the ANNALES DE CHIMIE.

MESSRS. Guyton and Vauquelin made a report to the National Institute in Fructidor, year 9, (Sept. 1801,) on a new process, by M. Curaudau, for making artificial alum. As this report is not generally known, we are the more desirous to communicate it to our readers.

For the making of alum, M. Curaudau proposes to employ 100 parts of clay and 5 of muriate of soda, dissolved in a sufficient quantity of water to give the mixture the consistence of paste. It is then made into cakes, and put into a reverberating furnace, in which a strong fire is maintained for two hours, or till the interior of the furnace begins to be red-hot. When the calcination is completed, and the clay is reduced to powder, it is put into a good cask, and a quarter of its weight of sulphuric acid is thrown upon it at several times, stirring it well each time. When the vapours of muriatic acid, which are thus

thus disengaged, are dissipated, the same quantity of water is then added as of sulphuric acid, and it is stirred as before. Such an expeditious combination ensues between the acid, the earth, and the water, that the mixture becomes hot, swells, and exhales very abundant vapours. At length, when the heat is somewhat moderated, more water must be added till there is about eight or ten times as much as of the acid.

The earth not serviceable for the formation of the alum being deposited and the liquor clarified, it is drawn off into leaden boilers. Then pour upon the sediment a quantity of water, equal to that of the liquor drawn off; this is added to the first. Lastly, mix with these leys a solution of potash, which must contain as much of that alkali as is equal in weight to a fourth part of the acid employed, and stir it. If the sulphate of potash be preferred, take twice as much as of alkali.

After some time the liquor, as it cools, forms crystals of alum; the quantity of which, when the crystallization is completed, amounts to three times the weight of the acid employed. This alum is refined by dissolving it in the smallest possible quantity of boiling water, and it is then as fine as the best alum of the shops.

As the sediment still retains some saline particles, M. Curaudau recommends to levigate it a third time with a sufficient quantity of water to extract the whole of the salt, and to employ this liquor instead of pure water for the second operation; by these means nothing is lost.

Thus the greatest part of the alum formed in the operation is obtained without any aid from artificial heat, which is an important advantage. The author advises the employment of the mother waters, which still contain alum and highly oxydated sulphate of iron, for the manufacture

manufacture of Prussian blue, for which they are extremely proper.

He considers the making of alum as particularly advantageous for the makers of Prussian blue, as they might calcine their clay at the same time with their animal matters without any augmentation of expense. They would have no occasion to add potash to it, and the presence of iron, instead of being prejudicial, would on the contrary prove extremely useful. If they even wished to manufacture alum for commerce, they might employ, in order to dissolve the mixture of alumine and sulphuric acid, instead of water, the solution of sulphate of potash arising from the levigations of their Prussian blue, of which in general no use is made. They might likewise employ for the same purpose distillers lime-rubbish, which contains alumine and potash proper for making alum. It would be sufficient to sprinkle that substance, reduced to powder, with sulphuric acid, and to add to the mixture the necessary quantity of water, proceeding as above directed. The mother waters of this kind of alum would likewise be useful for the making of Prussian blue.

It must be observed, that distillers lime contains more alkali than is necessary for the saturation of the sulphate of alumine formed by the clay, and that to extract all the virtue from that substance an eighth part of that earth calcined according to M. Curaudau's process should be added; and, by employing about 60 parts of acid to 100 of earth, at least 180 parts of very fine alum would be obtained.

By these different processes M. Curaudau declares that he has long made alum 25 *per cent.* better than that of the shops; and that, notwithstanding the low price to which that article has now fallen, he still has a profit of

10 or 12 *per cent.* upon it. He likewise says, that the manufacturers of Prussian blue, to whom the potash would cost nothing, would, even at the present time, obtain a profit of 17 or 18 *per cent.* from the artificial manufacture of this salt.

From the contents of the above report, it will be seen that M. Curaudau's memoir contains the result of facts and experiments made on a large scale, of great importance to manufacturers and commercial men, and on this account it appears highly proper to diffuse it.

Transactions of Societies for promoting useful Knowledge.

Economical Society of St. Petersburg.

At a late meeting of this Society, the prizes for this year were distributed. M. Nau, professor at Aschaffenburg, received the first prize for having produced the best mechanical apparatus for churning.

A large silver medal was adjudged to M. Rauschenplatt, junior, watch-maker, of Gottingen, for the next in merit.

To M. Wiese, tobacconist, at Pernau, a silver medal was decreed for a treatise on improvements in the culture of tobacco in the Ukraine.

Society of Agriculture and Commerce at Caen.

This Society last spring resolved to invite the artists and manufacturers of Calvados to exhibit such of their productions as were most interesting to the arts and commerce, in a place prepared for that purpose. The prefect

fect approved of this patriotic plan of the Society, and on the 25th Germinal (15th April) the hall of exhibition was opened to the public, who saw with satisfaction the multitude of curious and valuable objects produced by the industry of the town of Caen, and the department in general.

On the 25th of April the Society met in the same place where the exhibition had been held. Nine silver medals were distributed among those artists and manufacturers who appeared to the judges to deserve distinction or particular encouragement.

One was given to the inventor of an artificial leg, to replace the loss of a leg or thigh. This contrivance is at once simple and solid. The motions of the knee and foot perfectly imitate those of nature: in a word, the whole is an exact imitation of the natural leg.

A gun-maker obtained another, for the great number of workmen whom he continually employs.

A tanner received the same encouragement. Two lace-weavers attracted the attention of the judges; one for having executed a robe and tunic in very beautiful lace; the other, M. St. Jaure, for his admirable patterns, and the uniform beauty of his work.

Medals were likewise decreed to the porcelain manufactory, which successfully rivals all the others in France; to a manufacturer of Lisieux, and a citizen of Falaise; to the latter, for having introduced into the department the manufacture of a particular kind of handkerchief. The last was adjudged to a stocking-manufacturer, for the good quality and beauty of the articles produced by him.

Society of Grenoble.

From a memoir on the commerce with hackled hemp, read to the Society of Grenoble, by M. Berriat de St. Prix, it appears that the prime cost of a quintal of raw hemp is 50 francs; that when it is wrought it is worth 81 francs; from which must be deducted the interests of money advanced to the workmen and cultivators, and the credit given to purchasers. The same memoir shews that the commerce in hemp had increased very considerably in France within the last century; that Grenoble contains three hundred workmen, each of whom can prepare 60 quintals of hemp *per annum*, making a total for that town alone of 18,000 quintals.

Society of Agriculture of the Department of the Ardennes.

The Society of Agriculture, Arts, and Commerce, of this department, which meets at Mezieres, has just published the fourth part of its collection of Select Memoirs. It contains, among other interesting pieces, a dissertation on the propagation of pulpy fruit-trees in some of the cantons of the department; reflections on inundations, which are very frequent there, and on the means of preventing their disastrous effects; a report on a new plough; and several other papers; which evince the intelligence and zeal of that Society.

Athenæum of Arts at Paris.

The Athenæum of Arts held a public meeting on 11 June, under the presidency of M. Dessessarts, in the absence of General Berthier.

The secretary delivered an account of the most important transactions since the last meeting.

M. Rondelet read a fragment of a work on the construction of the vessels of the ancients, particularly gallies,

lies, with several rows of oars: and, in the inclination of the benches of the rowers, he has discovered the solution of a problem which has puzzled all the antiquaries and ship-builders.

M. Bernard gave a description of a penknife, with a scale, graduated in such a manner as to afford the advantage of giving a constant and regular inclination to the nib of the pen.

M. Salivet entered very minutely into the details of a new copper-plate printing-press, with copper rollers and continued movements, which give a great equality to the impressions, and permit a greater number to be taken off without any new arrangement of the press. For this improvement the inventor, M. Frappée, was presented by the president of the Athenæum with a gold medal.

M. Lecamus described M. Dellebarre's new microscope. Not contented with the degree of perfection he had given to that instrument thirty years ago, that artist has succeeded in augmenting its effect and facilitating its use; the Athenæum therefore decreed the venerable old man the maximum of its rewards, the crown and a medal.

A new lyre, with seven strings, by M. Morlane, was described by M. Famin; and the president rewarded the maker with a medal of encouragement.

Society of Agriculture of Boulogne.

On the 28 April, 1803, the Society of Agriculture, Commerce, and Arts, held its fourth public meeting.

The secretary presented a report of the labours of the Society since the last public meeting; after which he read a report from the commissioners appointed to examine a report presented for competition on the question relative to marls, proposed last year. It was not considered worthy

worthy of the prize, which was continued for the year 1804.

M. Isnardy then read a memoir on oxygen; in which, after presenting an historic sketch of the experiments which led to the discovery of oxygen gas and its properties, he enters into a detail of the applications which have been made of it to animal and vegetable physiology. He explains, with equal perspicuity and accuracy, the admirable phenomena of respiration, the circulation of the blood, and digestion: he shews the effects of oxygen in these different functions, presenting an interesting analysis of the experiments of Bichat. He then examines all the uses to which oxygen may be applied in the healing art, either to discover the nature of the air we breathe, to purify it, to prepare an air suitable for a patient labouring under this or that disease, or as an antiseptic in all disorders, internal or external, for which metallic oxyds are employed. He invites chemists to seek an easy and economical method of obtaining oxygen gas, and likewise processes to which every one might be capable of recurring, according to circumstances.

The sitting concluded with announcing the questions proposed for the subjects of the prizes to be decreed in the next public meeting, on 28 April, 1804.

1. It is generally acknowledged, that the practice of Marling is one of the most important improvements in agriculture. The Society will grant a prize to the memoir which shall best develope the nature of marls, their different kinds, and the methods of employing them to the greatest advantage, according to the nature of the soil. The author must principally confine himself to point out to farmers such exterior characters as will enable them readily to distinguish each kind of marl.

2. Sheep

2. Sheep are subject to a disease called staggers. The number of animals which perish by this malady may be computed at 3 or 4 in 100 *per annum.* Thus, if France contain 30 millions of sheep, the number which are carried off by this disease may be estimated at 900, or 950,000. This disease is occasioned by a bag, formed in the head of the sheep, containing an extremely limpid water and a white substance, divided like seed, and which, by the microscope, is discovered to be actual worms. It appears that, to cure this disease, it is necessary to open the head of the animal, and to extract this bag; but the operation appears so critical, and has hitherto been attended with such ill success, even at the Veterinary School of Alfort, that the Society has judged it to be of great utility to agriculture to propose a prize for him who shall point out the best method of treatment for the staggers in sheep, and how to cure them perfectly of that disease. He must be careful to support his processes, by properly authenticated experiments.

The prizes will consist of medals, to be delivered by the Society at its public meeting next year.

Galvanic Society, Paris.

On 28 May this Society, for the second time, performed experiments on a large scale, under the direction of its president and professor Aldini, at the Veterinary School of Alfort.

Animals of every size, from the insect to the horse, were subjected to the power of an apparatus of above 2000 disks, disposed in piles, communicating with each other.

Among other results, the following were remarked.

1. That the spark cannot be obtained as in ordinary electricity by explosion at a distance, but only at the point of contact.

2. That the electrometrical balance of Coulomb does not shew the electric tension in proportion to the number of couples and the force of the piles.

3. That it requires all the force of a formidable apparatus to kill a very small animal.

4. That Galvanic applications may determine, after death, the motions of inspiration and expiration. This was proved by holding a lighted taper to a small aperture, made in the tracheal artery of a horse, a quarter of an hour after death. At the moment of applying the Galvanic fluid, the flame was drawn inwards by the precipitation of the air into the lungs, and was blown from the aperture and extinguished when the fluid left the animal.

5. That contractions of the head and trunk of any animal may be produced by placing them at very great distances, and making them communicate with the pile by a single conductor, the other being formed by the common reservoir.

Central Committee for propagating the Cow-pox at Paris.

This committee has just published the general report of its labours for three years. It contains both the theory and practice of the new inoculation, so as to be capable of serving as a guide to those medical men who turn their attention to the subject. The minister of the interior, to whom the committee addressed the report, expresses his warm approbation of their labours, and also of the idea of opening a new subscription for the extinction of the small pox by the propagation of the vaccine pock. He patronizes this philanthropic design, and has subscribed the sum of 2000 francs for putting it in execution.

Intelligence relating to Arts, Manufactures, &c.

(Authentic Communications for this Department of our Work will be thankfully received.)

Phosphorus.

SOME of the German physicians have recommended the internal use of phosphorus in certain diseases. From the experiments made upon various animals by the Academy of Arts, Sciences, and Belles Lettres, of Turin, it appears that this substance, introduced into the intestines, takes fire, and is attended with very dangerous consequences.

Oxygenated Muriatic Acid.

M. Potel, of Dijon, some time since announced that oxygenated muriatic acid possessed the property of restoring drowned animals to life. M. Trannoy, of the Society of Emulation of Amiens, has proved, by numerous experiments, that this gas, instead of producing such an advantage, was of a suffocating nature, and could not but be very dangerous in cases of asphyxia.

New Vegetable Oil.

In the departments of Landes and L'Heraut, in France, an oily plant, called *Arachis*, of the family of lentils, *(Arachis Hypogæa,)* begins to be cultivated. It was brought by the Spaniards from Mexico, and was introduced by the French from Spain. An ounce of the oil of this plant, with a wick, a line and a half in diameter, burned nine hours twenty-six minutes. An ounce of olive oil, under similar circumstances, lasted only eight hours. Thus the oil of the arachis has the advantage of above one-eighth over olive-oil; and more or less over

every other kind of oil. It is an excellent substitute for olive oil for every other domestic use. It is preferable to all other sorts for the manufacture of soap. The seed yields nearly half its weight of oil.

Manufacture of Cloth.

The minister of the interior, the counsellors of state Crelet and Regnauld, Messrs. Conté and Molard, mechanicians, and Messrs. Ternau and Decretot, manufacturers, have lately inspected some machines, made by Mr. Douglas *, for the manufacture of cloth, under the superintendance of the committee of the Society for the Encouragement of Arts and Industry. They found at work four very perfect machines, for the following purposes:

1. A machine for scribbling wool, which scribbles 70 lbs. of Spanish wool in an hour. It requires only a force equal to that of two men, and a child to supply it with wool.

2. A machine for mixing the colours and scribbling. This machine mixes 40lbs. of Spanish wool *per* hour, and scribbles the same quantity. It requires a force equal to that of one person only, and a child to supply it.

3. A machine for raising the nap for shearing. This machine, worked by one man and a child, prepares a piece of yard-wide superfine cloth for shearing in two hours, and requires a force equal to that of an ordinary horse. It is equally suited to all cotton stuffs which require being raised, particularly coverlids. This machine performs two operations. The combs may be taken

* We have good reason to believe that this person is an Englishman, who was some little time since engaged in a similar manufactory in the neighbourhood of Lambeth, where we understand he was unsuccessful.

away;

away; and twelve brushes, to brush the cloth before it is pressed, may be fixed in their place.

4. A loom, with a fly-shuttle, and all its parts complete, worked by one person, placed in the middle.

Ingenious Application of Iceland Crystal to Telescopes.

Iceland crystal is known to possess the property of double refraction, and of giving two images. Of this M. Rochon has very ingeniously availed himself by placing a prism of this crystal in the inside of a telescope, which produces two images of the object observed, and these images are nearer or farther from each other according as the prism is more or less distant from the eye. If a ship be perceived at sea, which you have an interest in overtaking or avoiding, bring the two images in contact; if you are approaching the vessel the two images will gain upon each other; on the contrary, if the two vessels are removing to a greater distance from one another, the images will soon be perceived separate. It is easy to distinguish the rate or class of the vessel observed, and you will know nearly the dimensions of the mast. Bring in contact, end to end, the two images of the main-mast, and you will find how many masts length you are distant at the time from the vessel. By land you observe the images of a body of enemies, place the images so that the feet of one shall be on the head of the other; and if the average height of a soldier be computed at five feet six inches, the telescope will shew you how many times that length is contained in the distance which separates you from the enemy. This sketch is sufficient to explain the utility of an instrument which would be very interesting if it were only considered as an object of curiosity. The experiments with it were repeated at St.

St. Cloud, 11 Prairial, (31st May,) in the presence of the First Consul, who ordered several telescopes of this kind to be made.

This discovery may also be of great use in astronomy. M. Rochon has already employed it to measure the diameters of Mars, Jupiter, and Saturn. He could not at first apply it to the sun and moon, the diameter of which is about 30′, because the angle of refraction is only 20; but, by an ingenious method of cutting the crystals, Messrs. Rochon and Torelli di Narcy have doubled and trebled the angle of refraction; so that there is not now any planet whose diameter cannot be measured, if it be but sufficiently luminous; for it is obvious that the two images must be weaker than only one would be. But this inconvenience cannot be felt with regard to the sun and moon, which always diffuse too much light. One of these prisms will soon be adapted to the best telescope in the National Observatory.

Portsmouth Canal.

The estimates of the expense of the execution of the intended London and Portsmouth canal, and of its probable revenue when finished, being now perfected, it appears that the cost of the execution will be 721,000 *l.* and that the revenue will exceed 100,000 *l. per annum.* At a late general meeting at the Crown and Anchor, it was unanimously voted to open a subscription immediately for raising a capital of 800,000 *l.* in shares of 100 *l.* each, and to proceed to parliament for an act to carry the measure into effect. As this measure appears to us to be an important national object, we have subjoined an extract from Mr. Rennie's Report upon it.—He concludes his report thus: "When, therefore, the extent of country through which this canal will pass is considered; the communications that will sooner or later take place, not only

only with those navigations already made, but with others now in contemplation, and likely soon to be made; the abundance of ship-timber there is in the counties through which it will pass; the communications that will be opened with London, and with his Majesty's dock-yards at Portsmouth, Chatham, Woolwich, and Deptford, the city of Chichester, and the numerous towns and villages situated near to it; the various articles of traffic which must be carried between London and these places, and the local trade they will have with each other; the quantities of timber, naval and military stores, which must be carried to and from his majesty's dock-yards, without being liable to the hazards of the sea, and uncertainty of the voyage, or risk of being taken by the enemy's cruizers: the quantities of goods which will be sent by the East India Company to their vessels when lying at Spithead; the immense quantities of chalk, from the inexhaustible chalk-pits bordering on the line, for manure; the quantity which will be wanted in London for lime, which is of an excellent quality, the quantity of coals, &c. &c. I say, taking the whole of these into consideration, I think this is one of the most important lines of inland navigation which have come under my observation."

List of Patents for Inventions, &c.

(Continued from Page 240.)

James Roberts, of Abbotston-Farm, Southampton, Yeoman, and George Cathery, of New Alresford, in the same county, Gentleman; for a method of compleatly and effectually eradicating smut from wheat; and that wheat, when cleansed by their invention, will produce flour

flour of as good quality and value as flour made from wheat of the best growth. Dated July 6, 1803.

JOSEPH MANTON, of Davies-street, Berkeley-square, in the parish of St. George, Hanover-square, Middlesex, Gun-maker; for a hammer, upon a new construction, for the locks of all kinds of fowling-pieces and small arms. Dated July 6, 1803.

JAMES STUARD, of London-street, in the parish of St. Dunstan Stepney, Middlesex; for a method to strengthen ships or floating vessels. Dated July 27, 1803.

JOHN NORTON, of Rolls-buildings, Fetter-lane, Fleet-street, London, Mathematical Instrument-maker; for an improvement in the construction of a water-mill. Dated July 28, 1803.

THOMAS KENTISH, of Baker-street North, Portman-square, Middlesex, Esquire; for a dewick, for the purpose of more expeditiously, with less labour, and at less expense than heretofore, loading and unloading ships and vessels, removing heavy bodies in any direction, and which is also applicable to other useful purposes. Dated July 29, 1803.

ARTHUR WOOLF, of Wood-street, Spa-fields, Middlesex, Engineer; for an improved apparatus for converting water or other liquid into vapour or steam, for the working steam-engines, for the heating of water or other liquid employed in brewing, distilling, dying, bleaching, tanning, and other processes connected with arts and manufactures; calculated also to make a stronger extract than can be obtained by the processes commonly in use from a given quantity of any vegetable or other substance from which extracts are or may be made without the danger of burning, scorching, or singeing, such vegetable or other substance, and applicable to various other pocesses. Dated July 29, 1803.